Installation of tidal turbine array at Kyle Rhea, Scotland

Scoping Study

Marine Current Turbines

22 March 2010
Final Report
9V5627

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Document title	Installation of tidal turbine array at Kyle Rhea, Scotland Scoping Study
Document short title	
Status	Final Report
Date	22 March 2010
Project name	
Project number	9V5627
Client	Marine Current Turbines
Reference	9V5627/R/303719/Edin

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1 INTRODUCTION

1.1 Background

As part of their ongoing development programme, Marine Current Turbines Ltd (referred to hereafter in this report as MCT) proposes the installation of an array of tidal turbines for the commercial production of electricity in Kyle Rhea, a narrow strait between the Isle of Skye and mainland Scotland. Kylerhea, also discussed in this report is a village to the south west of the Kyle Rhea. The combined generation capacity of the array will be up to 5MW, comprising of four of SeaGen tidal turbine devices, with the capacity of each device of 1.2MW. The development of this array represents a natural progression in development, following the successful installation and operation of a single SeaGen device in Strangford Lough, Northern Ireland, the world's first commercial tidal turbine.

This environmental scoping report provides initial background information and determination of the environmental constraints and benefits associated with the construction and installation of an array of tidal turbines in Kyle Rhea. As such, this report represents the first key stage in the Environmental Impact Assessment (EIA) process and has been produced to facilitate the identification and assessment of the potential environmental impacts associated with the project. The report will also ensure that all consultees are fully aware and informed of the scheme.

An initial site selection exercise was conducted by MCT, supported by Royal Haskoning, and included early consultation with Scottish Natural Heritage (SNH) and Marine Scotland (MS), as well as the Energy Consents Unit of Scottish Government. Royal Haskoning was commissioned to write an environmental scoping of the Kyle Rhea site in preparation for the submission of a full Environmental Statement (ES) to accompany applications for consent for installation of the array (see Section 2, Policy and Legislation).

The objectives of this report are to:

- Outline the technology to be installed on site;
- Briefly describe the techniques proposed for installation and highlight options still under consideration;
- Identify and summarise the known baseline conditions on site;
- Identify environmental constraints and benefits of the site;
- Consider and suggest possible environmental impact which may arise from the development;
- Identify any studies required for assessment of the project; and
- Identify the most appropriate approach to studies and subsequent impact evaluation.

1.2 Project Description

1.2.1 Technology

The technology which is proposed for the Kyle Rhea tidal array is based upon the SeaGen device installed and successfully operated in Strangford Lough, with some minor improvements or alterations to the design. The SeaGen turbine in Strangford Lough is one of the most studied, tested and reliable designs in the world.

Tidal turbines are, in principle, similar to submerged windmills driven by high tidal current velocities, deriving energy from huge volumes of flowing water. However, as water is 800 times denser than air, tidal turbines can be smaller in scale than wind turbines and devices within arrays can be positioned closer together because tidal streams generally provide bi-directional movements rather than the multidirectional movements of wind.

The basic requirement for cost-effective power generation from tidal streams is a mean spring peak velocity exceeding about 2.5 metres per second (m/s). Such flows have the major advantage of being an energy resource as predictable as the tides which cause them, unlike wind or wave energy which respond to the less predictable dynamics of weather systems.

The SeaGen turbine developed by MCT consists of axial flow rotors, of 16 - 20m in diameter, which drive a generator via a gearbox, much like a hydro-electric turbine or a wind turbine. The rotors turn at a maximum of 14.3rpm with a tip speed of each rotor is a maximum of 12m/s. Twin rotors are mounted on a wing-like cross beam, extending either side of a tubular tower, which itself protrudes approximately 10m above the water surface (during Mean Sea Level). The cross beam can be raised above the water surface on hydraulic rams to allow efficient maintenance and repair as required. Subsurface, each SeaGen turbine is likely to be mounted on a quadropile drilled and pinned into the seabed providing high stability with a minimal direct seabed footprint of approximately 3.1m^2. The minimum depth of the rotor tips will be 3m to allow smaller vessels to pass close to the tower and during most states of the tide the depth will be considerably more.

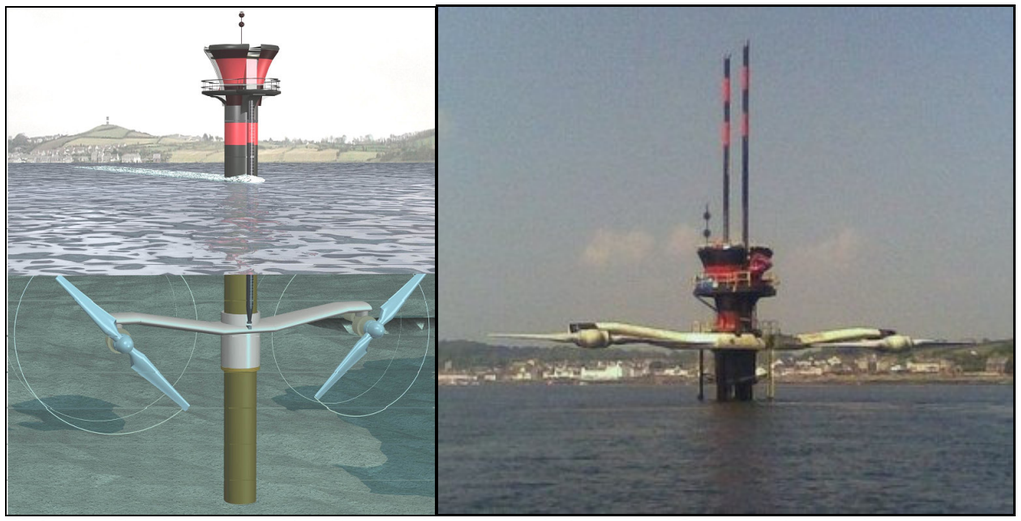


Plate 1.1: Graphic Image of the Seagen device and photograph of Seagen with crossbeam raised.

1.2.2 Site selection

A site selection process was carried out to identify and assess potentially suitable sites for the small array in the UK. An evaluation of alternative sites using weighted comparative criteria was undertaken by the MCT project team to assess and justify site selection. Determination of site suitability comprises a number of components, characterised by the following main criteria:

- Weather exposure;
- Proximity to grid connection;
- Environmental sensitivities;
- Tidal flow regime energy;
- Bathymetry (22-35m depth);

- Site accessibility from local and national perspective; and
- Logistics and proximity to marine operations support.

Whilst it is recognised that each site considered is unique, the multiple criteria approach outlined above justified the selection of Kyle Rhea as the optimum site for the establishment of a temporary evaluation system of the marine current turbine.

Key factors that identified Kyle Rhea as an ideal site to locate the proposed tidal array included:

- The high current velocities likely to be encountered, predominantly in well defined bi-directional flows, providing a complete spectrum of velocities for the prototype technology to be trialled under;
- The wave sheltered environment of the kyle presents a number of advantages, including ease of maintenance and access and increased safety even during winter months.

In addition to the key points above, the 'in principle' support from the relevant authorities and stakeholders in Scotland was an important factor in the choosing of Kyle Rhea.

It is therefore considered that siting a small array of tidal turbines in Kyle Rhea could significantly accelerate the development of a clean renewable energy technology in the UK in a way not possible at other sites.

1.2.3 The site

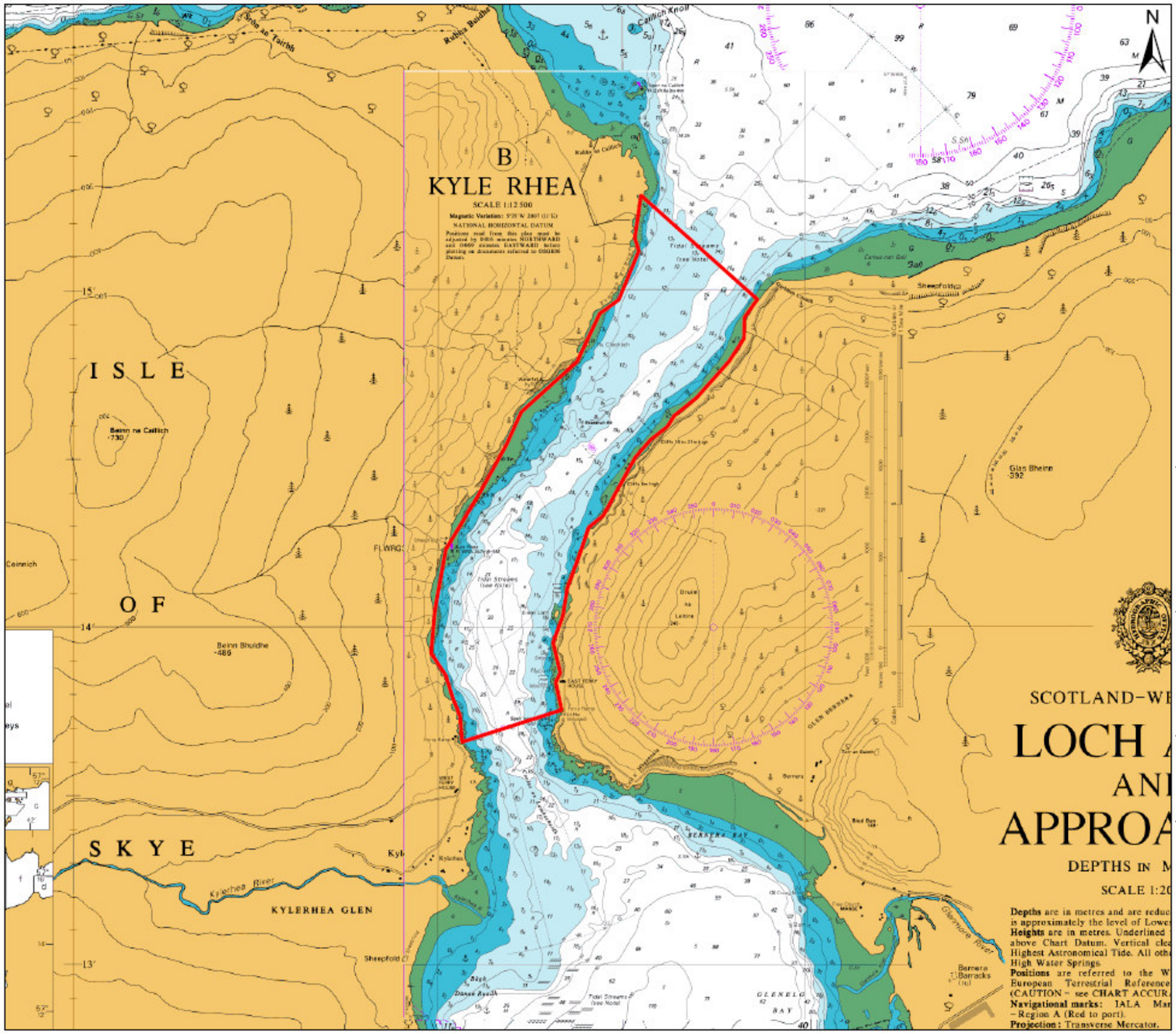
The site boundary for this scoping study is shown in Figure 1.1, and encompasses the majority of Kyle Rhea, an area of approximately 2km^2.

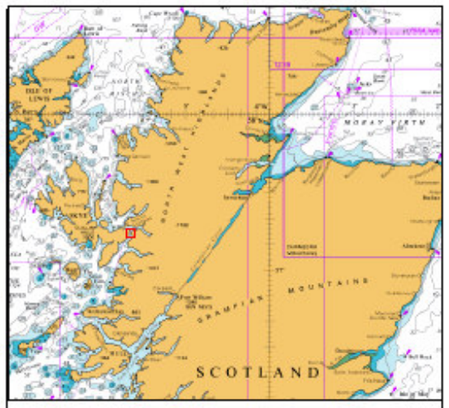
Onshore infrastructure is likely to include construction of a substation on the shore adjacent to the array (this could be either side of Kyle Rhea) and directional drilling between the substation and the array. The substation will connect to the national grid via existing infrastructure.

A detailed layout and position of the array will be finalised after collection of key data and identification of key constraints, for example, seabed characteristics and ecology.

The site is accessible from both the mainland, via the Old Military Road to Gleneig off the A87 south of Loch Duich, and from the Isle of Skye, via a minor road from the A87 at Ashaig to the settlement of Kylerhea. Immediately south of the proposed site, a small ferry crosses the Kyle between Gleneilg and Kylerhea during the summer. A minor airport is present on the Isle of Skye, with the nearest large airport at Inverness, approximately 1 hour away.

It is anticipated that the majority of material and equipment for construction and installation will be transported by sea. However, detailed logistical plans would be finalised at a later stage.





Legend:

Proposed Site Boundary

Title:

KYLE RHEA SITE BOUNDARY

Project:

KYLE RHEA TIDAL ARRAY

Source:

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MARINE CURRENT TURBINES

Drawn by:	Checked:	Drawing No:
SKM	GB	9V5627/01/001
Date: 23/02/2010		Figure: 1.1
Scale: 0 250 500 Meters		Revision No: 002

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1.2.4 Installation Methodology

Installation of the devices is expected to follow a similar method to that for the SeaGen device in Strangford Narrows. The overall period for installation will be approximately 6 months; however this may be extended or modified to best manage potential environmental constraints.

Four holes for each device will be drilled into the seabed to take the pin piles securing the legs of the quadropile. Rock cuttings will vary in size from gravel through to clay particle size and flushing material will be seawater, eliminating any possible contamination from drilling fluids. Once the quadropile has been positioned it will be secured in place using pin piles and cement grout.

Plate 1.2: SeaGen quadropile lowered into position.

Operation of the tidal devices will be via a remote control room; however each of the devices also has control facilities on board which can be used during testing periods.

The minimum design life of the devices is 25 years.

2 POLICY AND LEGISLATION

2.1 Renewable energy policy in Scotland

Scotland's geography and climate offers enormous potential for the development of renewable energy resources. The estimated potential energy generation from tidal resource in Scotland is 7.5GW (Garrad Hassan, 2001). Following a change in Scottish Government in 2007, a new target was created to generate 50% of Scotland's electricity from renewables by 2020 (following a previous target of 40%), with an interim target of 31% by 2011. This is inline with the Climate Change (Scotland) Act 2009 which provides a statutory framework for greenhouse gas emissions, requiring an 80% reduction by 2050 and an interim 42% reduction by 2020.

Scottish Planning Policy 6: Renewable Energy (March 2009) defines the factors which planning authorities will consider when reviewing renewable energy development applications. The Highland Renewable Energy Strategy reflects SPP6. Planning Advice Note 45, Renewable Energy Technologies (Revised 2002) also provides advice on good practice.

Tidal turbines represent a novel method for generating electricity from a huge energy resource that:

- Produces no pollution during operation;
- Delivers energy to a predictable timetable; and
- Has the potential to make a major contribution to future energy needs.

2.2 Planning Legislation

The production of an Environmental Statement (ES) is required to accompany a planning application for the proposed development under the following legislation.

Electricity Act, 1989, Section 36

Under Section 36 of the Electricity Act, 1989 consent is required from the Scottish Ministers for the construction, extension and operation of a tidal power generating station with a capacity of 1 MW or more. On granting consent under Section 36, the Scottish Ministers can also decide that planning permission for onshore elements is deemed to be granted, if requested to do so. The capacity of the proposed tidal site will be up to approximately 8MW. Consent for the tidal site will therefore be required under Section 36 of the Electricity Act. A license to generate electricity will also be required.

The Marine (Scotland) Act 2010 allows an application to made under section 36 of the Electricity Act and an application for a Marine Licence (see later) to be made as part of the same application. This will simplify and streamline the licensing process.

EIA Directive, 1985 (amended 1999)

The EIA directive ensures that the environmental consequences of projects are identified and assessed before authorisation is given. The public can state their opinion and all results are taken into account before permission is granted.

The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations, 2000.

The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 implement the EIA directive, 1985 (as amended, 1999). This outlines the requirement for assessment of the effects of certain public and private projects on the environment. This relates to applications for consent to construct, extend or operate a power station or install overhead electricity lines under Sections 36 and 37 of the Electricity Act.

Under the Regulations developments that are considered likely to have significant effects on the environment must be subject to EIA and an Environmental Statement (ES) must be submitted with the Section 36 application.

Schedule 1 of the Regulations lists those developments for which EIA is mandatory, whilst Schedule 2 describes projects for which the need for EIA is judged by the Scottish Ministers on a case-by-case basis through a screening process. The proposed tidal site is a Schedule 2 development and therefore if it is considered likely to have significant environmental effects because of factors such as its nature, size or location, it is then considered an 'EIA development', and a formal EIA is required.

Under Regulation 7, the developer of an EIA development may ask the Scottish Ministers, before submitting an application for a Section 36 consent under the Act, to state in writing their opinion as to the information to be provided in the Environmental Statement (i.e. to provide a 'Scoping Opinion').

The request for a Scoping Opinion must be in writing and should include basic information on the proposed development including:

- A plan which identifies the site which is the subject of the proposed development;
- A brief description of the nature and purpose of the proposed development and its possible effects on the environment; and
- Further information or representations the developer may wish to provide.

The EIA regulations Guidance Note (Scottish Government, 2000) states that the developer should also submit a draft outline of the Environmental Statement, giving an indication of what they consider to be the main issues. Once they have all the information they require, the Scottish Ministers are required to consult and obtain the views of the Consultative Bodies (the Planning Authorities of the area in which the development is planned, Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA), the developer and other organisations (as they see fit). When the Scottish Ministers issue a Scoping Opinion, they must state what information should be included in the Environmental Statement, giving their reasons why.

Other relevant Environmental Impact Assessment Regulations are as follows:

- Marine Works (Environmental Impact Assessment) Regulations 2007; and
- Environmental Impact Assessment (Scotland) Regulations 1999.

The following consents may also be required:

Food and Environment Protection Act, 1985, Section 5 Part II

The Tidal Site will require a licence under Section 5 of the Food & Environmental Protection Act 1985 ("FEPA licence") from the Scottish Government (Fisheries Research Services). Under the Marine (Scotland) Act 2010 a single Marine Licence will replace the separate FEPA licence and CPA licence (see Coast Protection Act below).

Coast Protection Act, 1949, Section 34

The Tidal Site will also require consent under Section 34 of the Coastal Protection Act (CPA), 1949, from the Scottish Government (Ports and Harbours).

Consenting under FEPA and CPA will be replaced by a unified Marine License under the Marine (Scotland) Act 2010. The mechanism for granting of the Marine License will also incorporate consent under S36 of the Electricity Act, as appropriate.

In March 2010 the Marine (Scotland) Act was enacted. As a result, separate applications under the Coastal Protection Act, Food and Environment Protection Act, and the Electricity Act will be superseded by a more simplified streamlined application for a Marine License and Section 36 consent..

Marine Act
The Marine (Scotland) Bill was passed by the Scottish Parliament on February 4, 2010 and was enacted in March 2010. It aims to meet demands from a wide diversity of marine users for better stewardship and management of Scotland's valuable and iconic seas. Marine Scotland was established on April 1, 2009 as a directorate of the Scottish Government to manage the marine environment in Scotland

The Act introduces a framework for the sustainable management of the seas around Scotland, ensuring the need to protect our seas is integrated with economic growth of marine industries. It introduces:

- Marine planning: a new statutory marine planning system to sustainably manage the increasing, and often conflicting, demands on our seas;
- Marine licensing: a simpler licensing system, minimising the number of licences required for development in the marine environment to cut bureaucracy and encourage economic investment;
- Marine conservation: improved marine nature and historic conservation with new powers to protect and manage areas of importance for marine wildlife, habitats and cultural features;
- Seal conservation: much improved protection for seals and a new comprehensive licence system to ensure appropriate management when necessary; and
- Enforcement: a range of enhanced powers of marine conservation and licensing.

Town and Country Planning (Scotland) Act, 1997, Section 57
A request to the Scottish Government for planning permission under Section 57 of the Town & Country Planning (Scotland) Act will be made therefore negating the requirements for a separate planning application.

Energy Act 2004
The requirements for offshore installation developers to prepare decommissioning plans will be considered. The Act also provides the Crown Estate with rights to licence generation of renewable energy out to the 12nm limit and to 200nm where the site is within the Renewable Energy Zone

Water Environment and Water Services Act,
This implements the Water Framework Directive 2000 including the prevention and elimination of pollution from the marine environment. Under Section 20 of this Act the Controlled Activities Regulations (2005) provide ministers with powers to introduce regulatory controls over activities in order to protect the water environment. General binding rules provide statutory controls over low risk activities such as laying of cables. Registration may be required to cover low risk activities which cumulatively pose a risk to the water environment or a licence may be required for the company to carry out certain activities. The level of cover required is at the discretion of SEPA.

Planning Policy and Guidance
Government planning policy and guidelines are outlined in a number of documents including the National Planning Framework (NPF), Scottish Planning Policies (SPPs), National Planning Policy Guidelines (NPPGs), Planning Advice Notes (PANs) and Planning Circulars.

Lease of the Seabed
The seabed is owned by The Crown Estate (TCE). Sea Generation Ltd is in discussion with TCE regarding a lease to construct and operate a tidal array this site.

2.1 Appropriate Assessment

Kyle Rhea is within a marine Special Area of Conservation (SAC), designated under the Habitats Directive (Council Directive 92/43/EEC). Under the 'Conservation (Natural Habitats & c.) Regulations 1994 (as amended), which transposes the Habitats Directive into UK law, an 'Appropriate Assessment' must be undertaken in respect of any plan or project which:

- Either alone or in combination with other plans or projects would be likely to have a significant effect on a European site (SAC or SPA); and
- Is not directly connected with the management of the site for nature conservation.

The data gathered in relation to the EIA will provide much of the information required to support Appropriate Assessment (AA) for the proposed tidal array, although it may be necessary to collect some additional data.

An Appropriate Assessment will consider the impact of the proposed tidal turbine development on the integrity of the Lochs Duich, Long and Alsh SAC. Marine Scotland as the competent authority, advised by Scottish Natural Heritage as statutory nature conservation advisor in Scotland, can only agree to a project after having ascertained "beyond reasonable scientific doubt" that a site will not be adversely affected by the installation of a device, unless the proposed development is of overriding public interest.

The Appropriate Assessment must also take into account the cumulative impacts of other recent developments and planned developments within the study area.

2.2 Conservation Legislation

The Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('The Habitats Directive') aims to conserve biodiversity, providing a list of priority habitats (Annex I) and species (Annex II) to be protected by Special Areas of Conservation (SAC), part of a Network of 'Natura 2000' sites. The Conservation (Natural Habitats, & c.) Regulations, 1994 (including 2004 and 2007 amendments in Scotland) transpose the Habitats Directive into national law and outline the designation and protection required for 'European sites' and European protected species' (EPS).

The Nature Conservation (Scotland) Act 2004 places duties on public bodies in relation to the conservation of biodiversity and outline the required protection for Sites of Special Scientific Interest (SSSI).

The 1992 Convention on Biological Diversity in Rio de Janeiro called for the creation and enforcement of national strategies and action plans to conserve, protect and enhance biological diversity. In 1994 the UK government outlined the UK Biodiversity Action Plan (UK BAP) in response to the Rio Convention

The Convention on the Conservation of Migratory Species (The Bonn Convention) aims to conserve migratory species and their habitats. The common dolphin is providing strict protection for endangered migratory species, listed under Appendix 1 of the Convention. This has been ratified in the UK by the Wildlife and Countryside Act

Wildlife and Countryside Act 1981 ratified the Bonn convention. Harbour porpoise, common dolphin and bottlenose dolphin are listed under Schedule 5 and it is an offence to intentionally kill, take, possess or trade in this species.

The Nature Conservation (Scotland) Act 2004) was launched to amend and improve the species protection provided by the Wildlife and Countryside Act and introduces reckless disturbance as an offence.

The Scottish Marine Act 2010 includes significant changes to current seal legislation. The Act introduces enhanced seal protection measures while allowing for appropriate management under a new licensing system.

Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive') provides a framework for the conservation and management of wild birds in Europe. The directive provides broad objectives for a variety of human activities and requires favourable conservation status of all wild bird species across their natural range. Special Protection Areas (part of the Natura 2000 network of sites) are designated under the Birds Directive for species listed under Annex I of the directive as well as for all regularly occurring migratory species. The Birds Directive is due to be amended during 2010.

3 PHYSICAL ENVIRONMENT

3.1 Physical processes and geomorphology

3.1.1 Existing Environment

Bathymetry – Admiralty charts

The central channel of Kyle Rhea contains deep reaching a maximum depth of 36 m (Figure 1.1). At the entrances to the strait the seabed rises to depths of just 11.4 m at the southern end and 16 m at the northern end. The seabed bathymetry across the proposed site extends from the intertidal to a maximum depth in excess of 36 m (Figure 1.1; Admiralty chart 2541). It is the deeper waters toward the southern end of the strait that are at a suitable depth for turbine installation.

Wind

The dominant wind direction in the region shows a moderate bias towards the south-west with mean wind speeds exceeding 3 m/s across Kyle Rhea for 75 per cent of the time (Barne *et al*., 1997). Kyle Rhea is sheltered from the dominant winds by the land mass of southern Skye.

Wave conditions

Wave heights are less than 1 m for approximately 75% of the time and only during 10 % of the year do they exceed height of 2.0 m (Barne *et al*., 1997). Data relating to exact wave conditions within Kyle Rhea are not yet available but the waters between the eastern most part of Skye and mainland Scotland are considered to be wave sheltered (Wilding *et al*., 2005) and are not exposed to the larger waves generated in the Atlantic.

Tides and tidal currents

Tidal flows to the North of Kyle Rhea (at 57°16'06"N, 5°44'06"W) are summarised in Table 3.1 (Source: Admiralty Chart 2541).

Table 3.1 Tidal flows to the north of Kyle Rhea (1 knot = 0.514 m/s).

Hours relative to High Water	Direction of tidal stream	Spring Rate (Knots)	Neap Rate (Knots)
-6	270	1.8	0.7
-5	265	2.1	0.8
-4	258	0.5	0.2
-3	125	0.1	0.0
-2	078	0.2	0.1
-1	079	0.4	0.2
0	98	0.5	0.2
1	91	1.4	0.6
2	81	1.2	0.5
3	89	1.0	0.2
4	60	0.5	0.4
5	271	0.9	0.2
6	270	1.6	0.6

Admiralty Chart No 25441 indicates maximum spring flood tide flows of 2.1 knots (0.8 m/s) with flood neap flows of zero knots (3 hours before high water) at the above location (Table 1).

As tidal movement is squeezed between Skye and mainland Scotland, tidal streams within Kyle Rhea can exceed 8 knots on both spring ebb and flood tides and 5 knots on neap flood tides (Admiralty Chart 2541). Flow through the strait can form a complex system of currents with an eddy occurring near the eastern edge of the sound where water may flow in the opposite direction of the main flow (Admiralty Chart 2541).

Solid Geology

The Lewisian Gneisses and Torridonian sandstones dominate the solid geology within the study area (Ramsay & Brampton, 2000)

Geological Conservation Review (GCR) sites

Allt Cracaig Coast Site of Special Scientific Interest (SSSI) lies approximately 2.5 km south of Kyle Rhea on the eastern bank of the Sound of Sleat. Here there is a good example of contact between Moine and Lewisian rocks which has not been deformed or metamorphosed (SNH, SiteLink).

Avernish SSSI which lies approximately 3.25 km to the north of Kyle Rhea is important because it gives a positive indication of the extent to which the ancient Lewisian basement has been affected by the Caledonian mountain building and provides evidence of the original relationship between the Moine and Lewisian (SNH, SiteLink).

Ard Hill SSSI is situated on the northern shore of Loch Alsh, approximately 3 km north of Kyle Rhea. This site provides excellent exposures of the Balmacara Thrust, the overlying Balmacara Nappe, and the underlying Kishorn Nappe, within the Moine Thrust Belt (SNH, SIteLink).

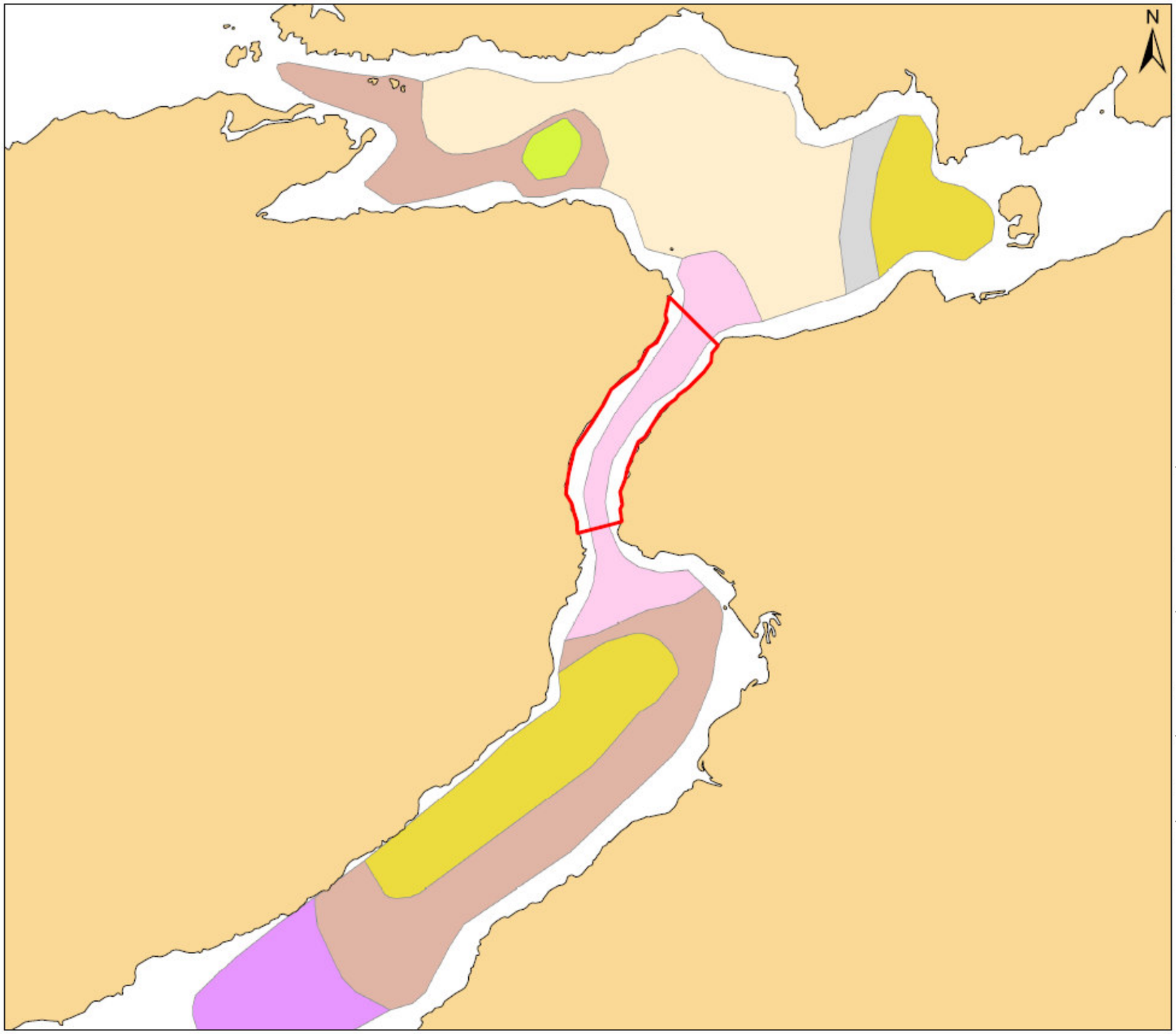
Seabed sediments

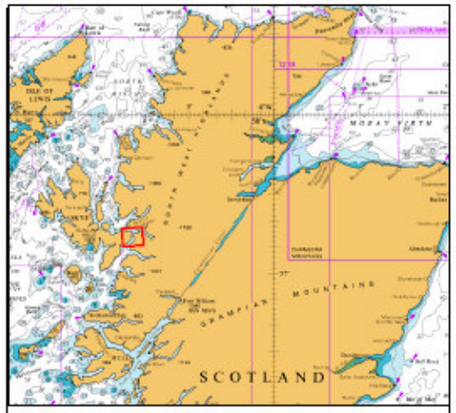
British Geological Survey Data (BGS) are displayed in Figure 3.1 and show the seabed of much of the Kyle to be composed of gravel. A separate more detailed survey indicated that the north end of Kyle Rhea is mainly composed of small cobbles and pebbles that overlay a bed of gravel and shell at 15-16 m depth. At the southern end, broken bedrock extends from 9-22 m depth, with drifts of coarse shell gravel at 12-13 m (Wilding *et. al*., 2005). A more recent study (Emu Ltd, 2006) found the strait to contain a mix of tide swept, gradually sloping bedrock, cobbles, boulders, pebbles and coarse sediment which is more in agreement with the Wilding *et al.* study than BGS data.

Sediment transport

It is understood that there is relatively little sediment transport along the coast of Western Scotland (Ramsay and Brampton, 2000). The region in which the study area sits is sheltered from the Atlantic swell by the Western Isles. Beaches are generally small and independent of each other. Along parts of the eastern Skye

coast, the sea is eroding the toes of the large landslips, such as that of the Quirang (located approximately 58 km northwest of Kyle Rhea), resulting in more or less continuous movement (Barne *et al.,*1997). Patterns of sediment transport through the strait of Kyle Rhea are currently not known.





Legend:

Proposed Site Boundary

- Gravel
- Gravel, Muddy, Sandy
- Gravelly Mud
- Gravelly Muddy Sand
- Gravelly Sand
- Mud
- Muddy Gravel
- Muddy Sand
- Sand
- Sandy Gravel
- Sandy Mud
- Slightly Gravelly Muddy Sand
- Slightly Gravelly Sand
- Undifferentiated Bedock Lithology

Title:

PHYSICAL ENVIRONMENT

Project:

KYLE RHEA TIDAL ARRAY

Source:

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MARINE CURRENT TURBINES

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GMC	GB	9V5627/01/002
Date: 22/02/2010		Figure: 3.1
Scale: 0 500 1,000 Meters		Revision No: 001

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3.1.2 Identification of key issues

Effects on geological formations: The extent to which the development will alter the geology of the area will entirely depend on the installation methodology. It is currently thought that the turbine devises will be pin piled therefore intruding into the underlying geology. The affected area will be very small causing little impact to the local geology.

Impacts to GCR sites: The proposed tidal development will cause no impact to GCR sites due to their distance from the proposed site which is greater than 2 km.

Effects on geomorphology and sediment transport: The effects of construction on geomorphology and sediment transport will largely depend on the eventual sitting and methodology for installation of the tidal devices. Surveys conducted during the EIA process will identify geomorphic features which may need to be avoided through micro sitting of the turbines and associated infrastructure. Due to the relatively low levels of sediment transport thought to occur within the site it is likely that installation and operation of a tidal array within Kyle Rhea will have little effect on sediment transport within the area.

Effects at the landfall location: Depending on the location of landfall and the methodology used for cable installation there may be small scale impacts to the local geology, geomorphology and sediment transport. At present it is anticipated that the main cable to land will be directionally drilled. Impacts are likely to be limited to the immediate vicinity of the cable landfall and a small area immediately adjacent to the array and will be short lived. Once methods and locations have been decided the EIA process will determine the significance of these impacts.

Effects on hydrodynamic regime: Modification to tidal regimes may have effects across three spatial scales during construction and operation, with progressively reducing intensity:

- Device scale – localised to the immediate vicinity of devices, such as lee effects and local scour;
- Near-field scale – on the scale of an array of devices or a licence area – device effects acting in combination;
- Far-field – effects extending beyond the project area.

Some alteration of the tidal currents as a result of increased friction or flow enhancement around each device or around the array may occur in Kyle Rhea. The Scottish Marine Renewables Strategic Environmental Assessment reports that no gross alteration of the tidal stream is expected to result from the installation or operation of tidal energy devices (Faber Maunsell and Metoc, 2007). The hydrodynamic regime would be expected to return to the preconstruction state once the project is decommissioned.

3.1.3 Methodology and approach to EIA

Data Requirement	Method	Data Sources
Bathymetric/ Geophysical site conditions (field study)	Multibeam bathymetric survey.	Marine Scotland Commissioned site survey
Baseline current flow conditions (field study)	Flow conditions measured through the complete tidal range using vessel mounted and sea bed Acoustic Doppler Current Profiler (ADCP). The effects of the array on flow conditions can subsequently be calculated / estimated.	Marine Scotland Vessel mounted ADCP survey in March 2010 is being carries out to allow appropriate precise placement of bottom mounted ADCP in a survey to follow.
Geophysical site conditions (desk study)	Metocean and Geotechnical studies commenced in March 2010	Previous survey data

3.2 Water/ sediment quality

3.2.1 Existing Environment

In other areas closer to the Kyle Rhea site water quality has decreased. A small stretch of water adjacent to Isle of Ornsay (located to the south of Kyle Rhea in the Sound of Sleat) deteriorated in quality in 2006 as did the waters around the Dornie, Loch Long (located approximately 7km northeast of Kyle Rhea). This drop in water quality was attributed to communities in these areas not having their sewage treated prior to discharge (SEPA, 2006).

Shell fish waters

Kyle Rhea became a “designated shell fish water” in 2002 due to the presence of the mussels *Mytilus edulis*. SEPA introduced a water and sediment monitoring program which commenced in 2003, but during 2006 and 2007 no mussels were found at the site and the site was declassified.

There are likely to be a small number of point source discharges from septic tanks into the Kyle from single houses on the shore, as well as from the settlement of Kylerhea. There is also a discharge from the Glenelg public septic tank (SEPA, 2009). A small vehicle ferry operates across the Kyle Rhea channel during summer months and also has some associated emissions.

During the five years of monitoring in compliance with the Shellfish Waters Directive – 2006/113/EC the Kyle Rhea site’s overall result was to “pass” (Table 3.1) on each occasion. This demonstrates that the site complied with strict physical, chemical and microbiological requirements set out by the directive.

Table 3.1 Compliance History of Shellfish water number 57 Kyle Rhea. Source: SEPA 2009.

	Compliance History for Waters and Biota, Excluding Faecal Coliforms Data			Compliance History for Faecal Coliforms
Year	**Overall result**	**Imperative**	**Guideline**	**Guideline**
2003	Pass	Pass	Fail	Fail
2004	Pass	Pass	Pass	Pass
2005	Pass	Pass	Pass	Pass
2006	Pass	Pass	Pass	No mussels found
2007	Pass	Pass	Pass	Pass

In 2003 silver concentrations found within mussel tissue exceeded safe levels set out in the directive and in 2003 and 2004 two of the six samples taken contained faecal coliform levels that also exceed safe levels. The unsafe levels of silver and faecal coliforms found in 2003 resulted in failure of the Kyle Rhea shellfish water to meet the standards set out in the directive. Since 2004 results for all parameters set out in the directive have been good, demonstrating that the overall water and sediment quality within Kyle Rhea is high.

Two other areas currently classified as designated shellfish waters exist approximately 7km to the North of Kyle Rhea.

Bathing waters regulations

The Kyle Rhea site is not classified as a Bathing Water.

Contaminated sediment

There is limited information currently available on levels of contamination of the sediment within the Kyle Rhea area. However, the nature of the hydrodynamic regime in the kyle, as well as the coarse sediment nature of the seabed, make significant contamination unlikely.

3.2.2 Identification of Key Issues

Impacts on water quality: Disturbance and resuspension of seabed sediments during construction will result in some increases in suspended sediment concentrations in the water column. This effect will be short-lived and is not expected to result in any significant impacts on water quality. During operation, leakage of hydraulic fluids, erosion of sacrificial anodes, and use of antifoulants have potential to impact adversely upon water quality. With the use of appropriate site management and control of chemicals it is considered that the risk of a pollution incident will be minimal. Effects on water quality experienced during decommissioning are likely to be similar to those of construction.

Leakage of pollutants from vessels and equipment used during installation could impact upon water quality.

Disturbance of contaminated sediments: There may be potential for some sediment within the site to be contaminated due to septic tank discharges. Disturbance of sediment during construction could release these contaminants into the water column with negative effects on water quality. Particular care would be taken with regards to the routing of the cable to shore, in order to ensure minimal disturbance near to outfall locations. However, as noted earlier, any significant accumulation of contaminated material is considered unlikely given the coarse nature of sediments present and the dispersive nature of the hydrographic regime.

3.2.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Water quality assessment (desk study and field studies if required)	Risks to water quality will be identified and assessed as part of the EIA, and mitigation measures recommended as part of construction and operation. Consultation with SEPA and Marine Scotland will identify any requirement for analysis of water quality and / or sediments.	Marine Scotland SEPA

4 BIOLOGICAL PARAMETERS

4.1 Ecological Designated sites

4.1.1 Existing Environmental

The features of interest for the key designated sites in proximity to Kyle Rhea are listed below, in Table 4.1 and the location of designated sites in the study area is shown in Figure 4.1. These will be discussed in further detail in the relevant sections (Marine Ecology, Ornithology, and Terrestrial Ecology)

Kyle Rhea lies within the Lochs Duich Long and Alsh (LDA) Reefs SAC which is designated for Annex I reef habitat. Other statutory international designated sites in the vicinity of Kyle Rhea include:

- Kinloch and Kyleakin Hills SAC; and
- Cuillins, Skye SPA.

Sites designated under national legislation in close proximity to Kyle Rhea include:

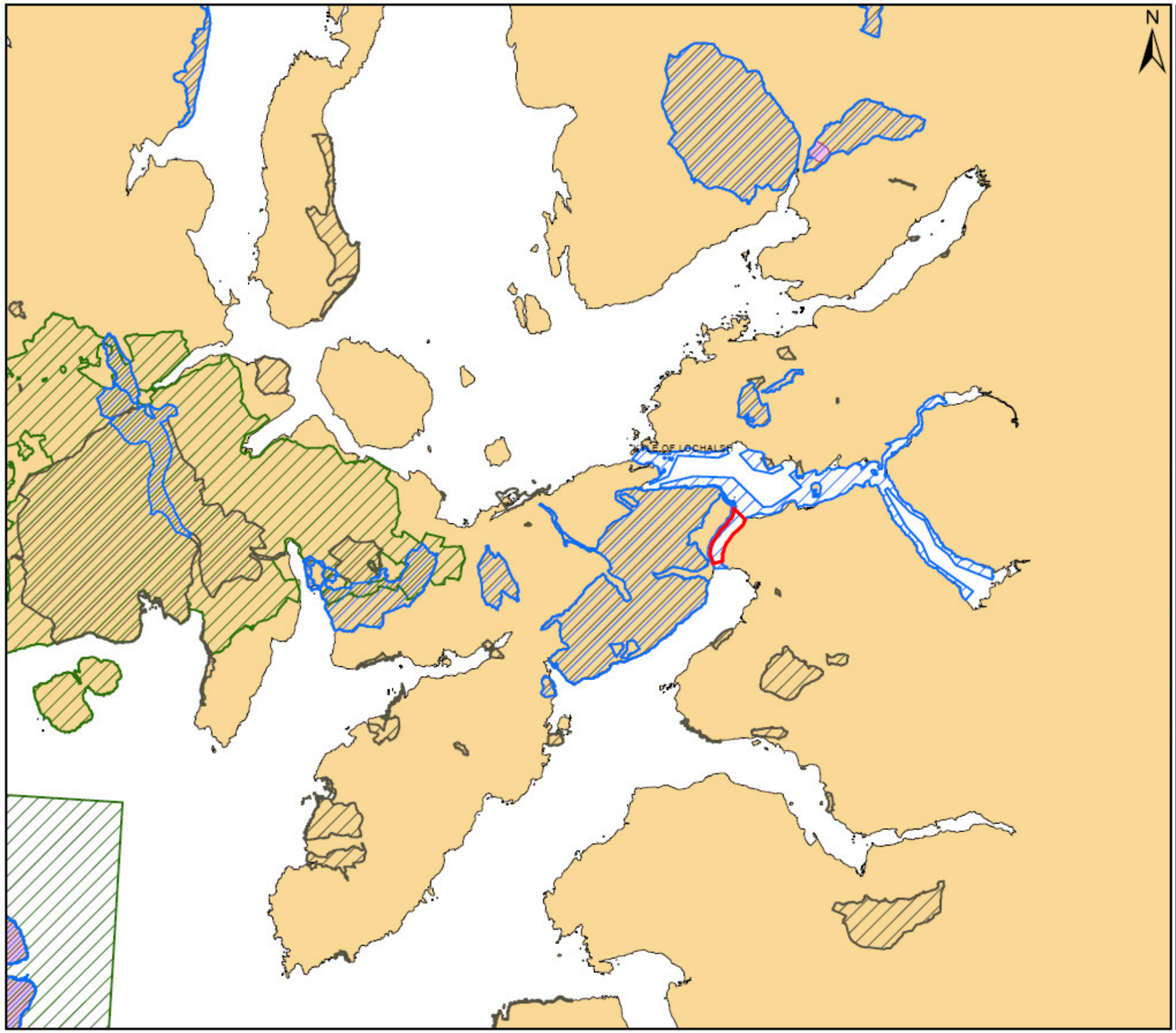
- Kinloch and Kyleakin Hills SSSI; and
- Allt Cracaig coast SSSI.

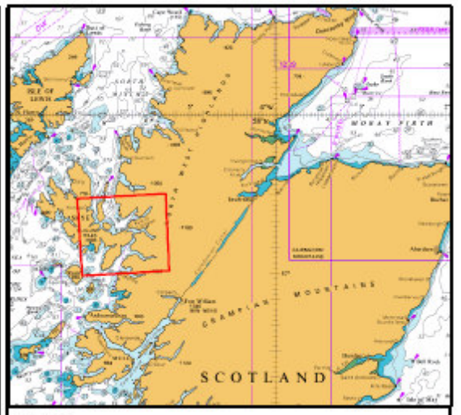
Cuillins is also a designated SSSI but due to the distance from Kyle Rhea this has not been included.

Sites of Geological Interest are discussed in Section 3.1, Physical Processes and Geomorphology.

Table 4.1: Summary of designated sites

Designated Site	Features	Location
Lochs Duich Long & Alsh Reefs SAC (within)	• Reefs	Encompasses Kyle Rhea and the surrounding sea lochs
Kinloch & Kyleakin Hills SSSI (within)	• Alpine heath • Blanket bog • Bryophytes • Lichen • Otter • Subalpine dry heath • Subalpine wet heath • Torridonian geology • Upland oak woodland	On the Skye, including the northern shore of Kyle Rhea.
Kinloch & Kyleakin Hills SAC	• Old sessile oak woods with Ilex and Blechnum in the British Isles (primary reason for site selection) • Northern Atlantic wet heaths with Erica tetralix • European dry heaths • Alpine and Boreal heaths • Otter	On the Skye, including the northern shore of Kyle Rhea.
Rum SPA species (SNH 2009).	• red-throated diver *Gavia stellata* (10 pairs; • 1% of GB population) and golden eagle *Aquila chrysaetos* (4 pairs)	40km southwest of Kyle Rhea
Cuillins, Skye SPA	• Golden eagle *Aquila chrysaetus*	On Skye, approximately 15km from Kyle Rhea
Ascrib, Isay and Dunvegan SAC	• Harbour seal *Phoca vitulina*	North west Skye, approximately 80km from Kyle Rhea.





Legend:
- Proposed Site Boundary
- Special Areas of Conservation (SAC)
- Sites of Special Scientific Interest (SSSI)
- Special Protected Areas (SPA)
- National Nature Reserve (NNR)

Title: DESIGNATED SITES

Project: KYLE RHEA TIDAL ARRAY

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Source data: Scottish Natural Heritage

Client: MARINE CURRENT TURBINES

Drawn by:	Checked:	Drawing No:
GMC	GB	9V5627/01/003

Date:	Figure:
22/02/2010	4.1

Scale: 0 1 2 3 4 5 Kilometres

Revision No: 001

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4.1.2 Potential Effects

The potential impacts on the features of interest for designated sites in proximity to Kyle Rhea will vary greatly depending on the nature of the sites and so these will be discussed in detail in the relevant sections (3.1 Physical Processes and Geomorphology, 4.2 Marine Ecology, 4.3 Ornithology and 4.4 Terrestrial Ecology).

The proposed tidal array will have a direct effect on the Lochs Duich, Long and Alsh SAC. The footprint of the area would be a maximum of 24.8m^2 in the Kyle Rhea study area of 1,980,000m2 and so the impact on the integrity of the site is expected to be minimal.

Advice provided by SNH (2006) highlights that the construction, presence and maintenance of structures, both within and adjacent to the Lochs Duich, Long and Alsh SAC have the potential to cause direct loss of reef habitat and deterioration of adjacent reef habitats and communities as tidal currents and therefore coastal processes are affected. The tidal array has the potential to affect local sediment suspension and deposition patterns and therefore the potential to cause deterioration of reef habitat through smothering effects. Installation, replacement and maintenance of undersea cables also have the potential to cause direct loss of reef habitat as well as local deterioration of reef habitats and communities. These effects are discussed in section 4.2, Marine Ecology.

4.1.3 Method and Approach to EIA and Appropriate Assessment

The investigations to inform future impact assessment in relation to designated features will be detailed in the relevant sections of this scoping study. The EIA will address the likely impacts on the nature conservation interests using worst-case scenarios.

Appropriate Assessment will be carried out in accordance with Department for Communities and Local Government (2006) outlining the likely significant effects, the effect on the LDA SAC integrity and any proposed mitigation or alternative solutions. Imperative reasons of overriding public interest will also be considered. The data collected during EIA (as discussed in Section 4.1, Marine Ecology) will provide adequate information for Appropriate Assessment.

4.2 Marine Ecology (including benthic and intertidal)

4.2.1 Existing Environment

BGS data shows Kyle Rhea to have a substrate of sandy gravel (Figure 8.1) however additional survey records show a mix of tide swept, gradually sloping bedrock, cobbles, boulders, pebbles and coarse sediment (Emu Ltd, 2008). This is confirmed by Wilding *et al.* (2005) who state that at the northern end of the narrow channel the substrate is made up of cobbles and pebbles, overlaid by gravel and shell at around 15m and at the southern end broken bedrock has been recorded.

Kyle Rhea is sheltered from wave exposure but has high tidal stream (Wilding *et al.* 2005). As a result this is expected to be a potentially highly changeable habitat, supporting species tolerant of fast water movements. The maximum depth in Kyle Rhea is 36mand, as discussed in section 1.2.2 (Site Selection) the depth range for the tidal array will be 22m to 35m.

Kyle Rhea is encompassed by the Lochs Duich, Long and Alsh SAC (see section 4.1, Designated Sites) and characterised by the biotopes under Connor *et al,* 2004 (Emu Ltd, 2006):

- CR.HCR.XFa.ByErSp.Sag, Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock;
- IR.HIR.KFaR.LhypFa*, Laminaria hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock: and
- IR.MIR.KR.LhypT.Ft, *Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock.

The former biotope was recorded in 21.3m and the latter two were recorded in 12.8m depth during diver surveys of the Lochs Duich, Long and Alsh SAC for Scottish Natural Heritage (SNH). At the shallower site abundant barnacles *Balanus crenatus* and diverse sponges (including *Halichondria panicea* and *Pachymatisma johnstoni*) were recorded (Emu Ltd, 2006). Within the kelp zone *Alaria esculentus* was the dominant kelp species and common animals included the anemone *Urticina felina*, and the bryozoan *Alcyonidium diaphanum* (Wilding *et al.* 2005). Other characteristic benthos included the anemone *Sagartia elegans,* along with coralline red algae, red algal turf and hydroid turf (Emu Ltd, 2006).

At the deeper site (21.3m) dead man's fingers (*Alcyonium digitatum*), hydroid turf, foliose red algae, *Hymeniacidon* sp. and barnacle (*Balanus crenatus*) were the key species recorded (Emu Ltd, 2006). Also recorded in deeper areas of the strait are bedrock and boulders supporting a rich and diverse community including hydroids (*Tubularia indivisa* and *Sertularia argentea*), the plumose anemone *Metridium senile* and the sponges *Myxilla incrustans* and *Pachymatisma johnstoni* (Wilding *et al.* 2005).

Plate 4.1 shows the sponges, *Pachymatisma johnstoni* and *Cliona* spp. along with deadman's fingers *Alcyonium digitatum* on boulders and cobbles.

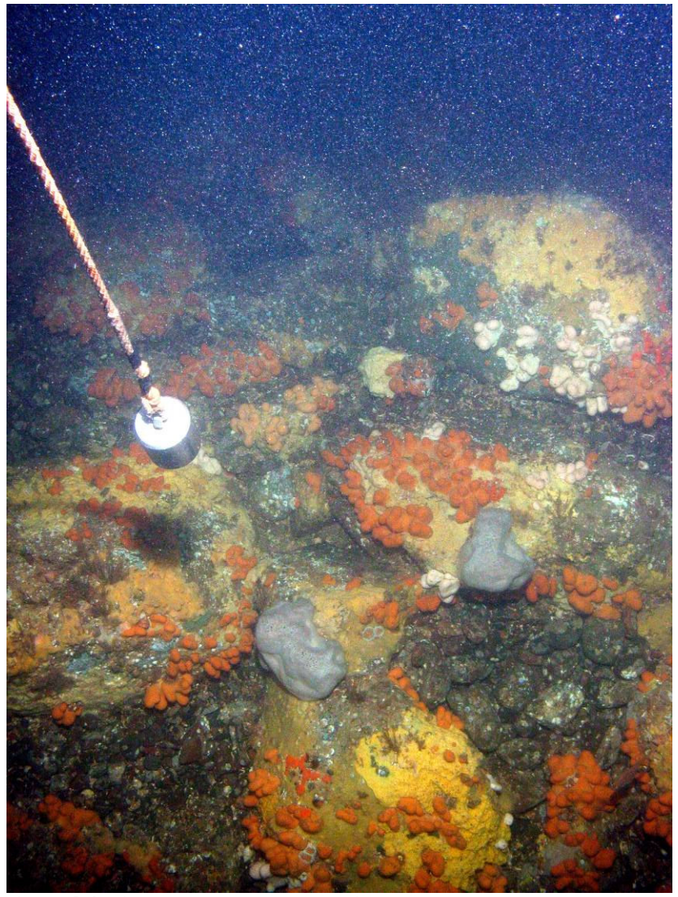


Plate 4.1: Benthic habitat in Kyle Rhea (image provided by Marine Scotland)

Designated Features

Reefs are an Annex I habitat feature under the Habitats Directive and are the primary reason for selection of the Lochs Long, Duich and Alsh (LDA) SAC. The reefs in Kyle Rhea are subject to some of the strongest tidal streams in the UK, and the bedrock in Kyle Rhea supports rich communities typically dominated by the hydroids *Tubularia indivisa* and *Sertularia argentea*, the barnacle *Balanus crenatus*, anemones, sponges and ascidians. The tide-swept reefs also support unusually dense beds of the brittlestar *Ophiopholis aculeata*, an extremely rare feature in the UK (JNCC, undated a).

A conservation objective of the Lochs Duich, Long and Alsh SAC, with regards to Kyle Rhea, is to maintain the extent, distribution, diversity and population density of characteristic species of the tide swept reef communities. The EIA will provide a comprehensive account of habitats and species present, particularly protected and rare/ threatened species and will outline the likely impacts based on a worst-case scenario.

No UK BAP species or habitats are known within Kyle Rhea. *Pachycerianthus multiplicatus* and *Phymatolithon calcareum* have been recorded approximately 6km to the north, in Loch Alsh, and *Funiculina quadrangularis* has been recorded approximately 10km to the south of Kyle Rhea. (SNH, 2010)

4.2.2 Identification of Key Issues

Physical disturbance: Construction activities will cause direct physical disturbance such as abrasion of the seabed. These impacts will be largely temporary and localised and the significance will depend on the habitats and communities present within the impact footprint and the size and nature of the footprint.

Habitat alteration: Areas impacted by installation activity will undergo habitat alteration during construction and again during decommissioning. The impact around the foundations will be discreet, but the works required for grid connection may result in additional areas of habitat change. Changes to tidal flow may alter the nature of the subtidal environment and result in changes in species composition. The devices are also likely to become colonised, forming an artificial reef. Given the specialist nature of species which live in high tidal streams it is expected that the species colonising the devices will be those which are already present in the area. Data from studies of the SeaGen turbine in Strangford Lough support a conclusion that any observed changes are relatively minor and are a result of a combination of normal seasonal variation and natural species competition and succession (Royal Haskoning, 2009). This supports the expectation that tidal narrows have a dynamic, changeable and robust ecology.

Habitat loss: Installation of foundations and other structures represents a direct long term loss of seabed habitat within the installation footprint, although this loss is ultimately reversible. The area of natural seabed lost will be very small in relation to the overall area of similar habitat likely to be encountered. The footprint of one device is 3.1m^2 and therefore a maximum of 8 devices would provide a habitat loss of 24.8m^2 within the current study area (shown in Figure 1.1) which has an area of 1,980,000m^2. In balance to the small habitat loss, the devices will provide an artificial reef feature which should provide substrata for the growth of a number of species.

Suspended sediments: Disturbance of sediments into suspension during construction and decommissioning activities will caused some limited increases water turbidity. There is some limited potential for contaminated sediments (see section 3.2) to be present.

Smothering: When suspended sediments settle back on to the seabed sessile organisms can be smothered resulting in limited supply of oxygen and food as well as the removal of wastes. The significance of this smothering will be dependant upon the sensitivity of the receptors present at the time and the quantities as well as the nature of sediment involved. Due to the coarse nature of the substrate it is anticipated that any suspended sediments would settle out rapidly in close proximity to the source. During drilling, particles sizes between gravel and fine clay may be produced. The finer particles may remain in suspension for longer periods but due to the tidal flow they would be rapidly dispersed.

Decommissioning: Following removal of the tidal devices it is anticipated that the benthic community would return fully to their pre installation state. The rate of return to pre-installation condition will depend on the presence of fauna in the surrounding area and environmental factors allowing for successful recruitment events. The fauna recorded within Kyle Rhea such as hydroids, sponges, anemones and dead man's fingers show high levels of recoverability (MarLIN, undated).

4.2.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Existing marine ecological data review (desk based)	Data relating to local hydrography, seabed sediments and benthic fauna will be requested / extracted from existing information sources and reviewed to identify the potential for presence of sensitive or important habitats and species.	Previous survey data held in NBN gateway website; MarLin website; MESH website
Site-specific benthic survey data (field based)	Acoustic data with drop down video/ still photography ground truthing will be used to establish the seabed type and potential habitat extents. Depending on the depth of the chosen array site drop down video or diver survey will be used to provide baseline monitoring data. Methodologies for benthic surveys are discussed further in Appendix I.	Survey guidance will refer to: Davies *et al.* (2001). Consultation with SNH and Marine Scotland

4.3 Ornithology

4.3.1 Existing Environment

Designated sites

The Cuillins Skye Special Protection Area (SPA) is located approximately 15km west of the proposed study area, and is designated solely for the Golden Eagle *Aquila chryaetus* population – The site supports 2.8% of the Great British breeding population of this species (JNCC, undated).

Rum SPA is approximately 40km southwest of the proposed study area and qualifies under Article 4.1 of the EC Directive 79/409 on the Conservation of Wild Birds (Birds Directive) by regularly supporting a population of European importance of the Annex 1 species red-throated diver *Gavia stellata* (10 pairs, 1% of GB population) and golden eagle *Aquila chrysaetos* (4 pairs, 1% of GB population) (SNH 2009).

The site also qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species Manx shearwater *Puffinus puffinus* (61,000 pairs, 23% of the world biogeographic population).

Rum further qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 130,000 seabirds including nationally important populations of the following species: black-legged kittiwake *Rissa tridactyla* (1,500 pairs, 0.3% of GB population), common guillemot *Uria aalge* (4,000 individuals, 0.4% of GB population), and Manx shearwater (61,000 pairs).

Seabird nesting counts 2000

The Seabird 2000 dataset is owned by the JNCC and contains data from a full census of all of the breeding seabirds in Britain and Ireland. The data were gathered between the years 1999 and 2003 from both coastal and inland colonies. The seabird nesting counts for the local area (in a 15km radius of the proposed site) are as follows, with the number of individuals shown in brackets (source: http://www.magic.gov.uk):

Black Guillemot *Cepphus grylle* (7) were recorded at the Saindaig Isles approximately 8km south of the proposed study area, and (39) at the Eilean Dubh, Uirnish to (but not including) Sandaig Islands site, approximately4.5 km west of the proposed study area

Common Gull *Larus canus* (12) were recorded at Loch Alsh, approximately 8km northeast of the proposed study area

Herring Gull *Larus argentatus (2)* were recorded at the Kyle of Lochalsh, approximately 6.5 km west of the proposed study area

Northern Fulmar *Fulmarus glacialis (892),* European Shag *Phalacrocorax aristotelis (42),* Common Gull *Larus canus (5),* Lesser Black-backed Gull *Larus fuscus (5),* Herring Gull *Larus argentatus (6),* Great Black-backed Gull *Larus marinus (4),* Arctic Tern *Sterna paradisaea (1) and* Razorbill *Alca torda (24)* were recorded at Sound of Pabay approximately 12.5 km west of the proposed site.

Birds observed in Kyle Rhea

The otter hide at Kyle Rhea reports on their website (http://www.forestry.gov.uk) regular sightings of the following species on the sea and shore in Kyle Rhea: oystercatcher *Haematopus ostralegus*, sandpiper (Scolopacidae), grey heron *Ardea cinerea*, dipper *Cinclus cinclus*, rock pipit *Anthus petrosus*, cormorant *Phalacrocorax carbo*, shag, eider *Somateria mollissima*, guillemot, gannet *Sula bassana*, kittiwake, fulmar *Fulmarus glacialis*, gulls and occasional white-tailed sea eagle *Haliaeetus albicilla* (National Biodiversity Network, 2008).

4.3.2 Identification of potential risks

The potential effect of the Tidal Site on ornithological interests is limited to those diving species that utilise marine and tidal waters for feeding. The impact of this form of energy production on birds is significantly less contentious and significant than the potential impact that wind turbines may have. Early consultation with SNH area staff members has suggested limited importance of the kyle for species such as gannet, guillemot and diving ducks.

Disturbance or displacement due to human activity and noise - The presence of increased human activity and specific construction and operation and maintenance and decommissioning impacts, including increase of vessel traffic in the area, construction noise and vibration will have the potential to disturb and displace birds from an area of use (for feeding, resting, passage, etc). However, existing data from studies at North Hoyle (RWE Group, 2005) and Horns Rev offshore wind farms (Christensen and Hounisen, 2005) indicate that, at these sites, the impact of construction works was not significant.

Human activity and noise would be of greater concern if the installation site is situated close to habitats that support relatively high numbers of feeding or breeding birds such as intertidal mudflats or offshore, unpopulated islands. There is potential for limited disturbance during construction of the cable route landfall to shore feeding species known to utilise the local area, including oystercatcher, sandpiper, dipper and rock pipit.

It is possible that any significant potential for disturbance could be avoided through careful selection of landfall sites and the avoidance of critical periods such as the breeding season and/or key wintering months.

Collision of diving birds with turbine rotors- The proposed operational depth maybe within the habitual feeding depth of some diving birds and there is therefore a potential for some interaction with those species if they are present during periods of strong tidal flow.

The types of birds likely to be affected relevant to Kyle Rhea include diving ducks such as eider, as well as cormorants. Diving seabirds are also possibly at risk, including auks (such as guillemots and razorbills), gannets and red throated divers. Manx shearwaters are open sea surface feeders, and kittiwakes and terns are shallow surface divers, and so these species are not considered to be at risk.

The rotors of the turbines will be a minimum 3m below the surface at low water, gannets are plunge divers, penetrating between 10-30m into the water, usually remaining submerged for less than 10 seconds during which time they swallow they prey. The depth to which birds actively forage depends on the species. Data from recorders attached to birds shows that species such as guillemots actively search for food between 15m and 60m, shag between 15m and 25m, eider duck 10m, pochard 10m and great northern diver up to 60m. As the majority of diving seabirds and waterfowl locate their prey by eyesight it is likely that they would be able to discern the presence of a relatively large structure such as a turbine in the water column and therefore contact would be avoided. Plunge diving species such as gannet may be at more risk of collision as active perception may not be utilised during the dive into the water. The above-surface section of the turbine may attract birds to rest upon the turbine, and therefore increase the likelihood of diving behaviour in the immediate vicinity of the turbine rotors. Navigational lights on the devices may cause some limited changes in bird behaviour at night.

It is likely, given the relatively slow rotational speeds of marine current turbine rotors, the relatively low mass of diving birds and laminar flow characteristics of water moving across the rotors, that if entrained in the current diving and swimming birds would pass harmlessly through the sweep of the rotors.

Loss of potential foraging habitat and food sources - Noise associated with the installation, for example vessel traffic, is unlikely to cause significant displacement of prey species (fish) within the turbine site. The footprint of the tidal turbine and onshore infrastructure would 'remove' a small percentage of the available habitat however the small footprint of this is unlikely to have a significant effect on the feeding ground for diving birds.

4.3.3 Methodology and approach to EIA

Data Requirement	Method	Data Sources
Determine the existence of birds (feeding, roosting, etc) in proximity to the proposed site. (desk based and field based)	Data could be obtained from previous surveys, collated from relevant organisations and/ or dedicated survey if suitable information is not available. Methodologies for baseline bird surveys are discussed further in Appendix I.	SNH RSPB BTO WWT Commissioned survey
Use of area by resident bird populations (desk based and field based)	Review data on average flight height/diving depth food sources, and feeding strategy. Methodologies for baseline bird surveys are discussed further in Appendix I.	SNH RSPB BTO WWT Commissioned survey
Use of area by migratory species on passage (desk based and field based)	Review data on relative abundance of local populations, average height at which they fly, timing of migration and how these factors are affected by the weather. Methodologies for baseline bird surveys are discussed further in Appendix I.	SNH RSPB BTO WWT Commissioned survey
Flow modelling of the Tidal Site (desk based)	Calculate predicted range of the turbine rotor speed and from this determine likely body size that could undertake safe passage through the rotor sweep.	FRS SAMS
Impact of the SeaGen device in Strangford Lough on birds	Reports to be available for review in April 2010	SMRU analyses Exeter University Study

4.4 Terrestrial Ecology

4.4.1 Existing Environment

Terrestrial Habitats

The Highland Local Biodiversity Action Plan identifies the coasts of Kyle Rhea to consist of a complex of heather moorland, coniferous woodland and broadleaved mixed woodland. Several short streams drain the steep topography from both sides of the Kyle.

The Kinloch and Kyleakin Hills SAC and SSSI, located on Skye approximately 500m west from the proposed development study area, designate a moderately high Torridonian sandstone hill with a range of oceanic habitats representing the more acid hills of Skye and the north-west Highlands and islands. These habitats include wet and dry heath, blanket mire, montane dwarf-shrub heaths, grasslands and summit moss-heaths. The Kinloch and Kyleakin Hills SAC is primarily designated for old sessile woodlands with *Ilex* (holly) and *Blechnum* (a fern) in the British Isles, but also contains the qualifying features of otters, northern Atlantic wet heaths with *Erica tetralix*, European dry heaths, alpine and boreal heaths, blanket bogs and *Tilio- Acerion* forests of slopes, screes and ravines. The Kinloch and Kyleakin SSSI is specifically designated for otters, alpine heath, blanket bog, bryophyte assemblage, lichen assemblage, subalpine dry heath, sub alpine wet heath, Torridonian geology and upland oak woodland.

Biological terrestrial designated sites within the region include Coille Mhor SSSI 5km to the north of the proposed study area and designated for upland oak woodland, dragonfly assemblage and oligotrophic lochs; Coille Mhialaridh SSSI, situated approximately 10km to the south of the proposed study area and designated for upland oak woodland; and Mointeach Nan Lochain Dubha SSSI, situated approximately 11km west of the proposed study area and designated for blanket bog and oligotrophic lochs. None of these SSSIs are expected to be impacted by the proposed scheme.

Intertidal Habitats

The shores of Kyle Rhea comprise predominantly of bedrock and boulders, with occasional small gravelly embayments. The coastline is steep-sided, leading up to a series of small vegetated coastal cliffs above the intertidal zones. The Skye and Lochalsh Biodiversity Action Plan identifies a small area of Machair like habitat at Glenelg, approximately 1km south of the proposed study area (http://www.magic.gov.uk). Machair is an Annex I habitat and UK BAP habitat, however this area of Machair is not mentioned in the citations for the SAC. Approximately 5km to the south of the proposed scheme, the BAP species *Ascophyllum nodosum* ecad *mackaii* has been recorded (SNH 2010) however this species has strong preference to very sheltered locations.

Otters

The European otter *Lutra lutra* is a semi-aquatic mammal, which is common around the freshwater and coastal areas of Scotland. UK Populations are internationally important, especially since their widespread decline across much of their western European range (JNCC, 2004). Populations in coastal areas utilise shallow, inshore marine areas for feeding but also require fresh water for bathing and terrestrial areas for resting and breeding holts (JNCC, 2004). Where otters live in coastal areas (particularly in Scotland) they tend to have a largely diurnal habit, live in group territories, and have home ranges below 5 km (Kruuk, 1996).

All otters found within Scottish waters are protected by a range of national and international obligations:

- Council Directive 92/43/EC on the Conservation of Natural Habitats and of Wild Fauna and Flora, Annex II and Annex IV (the 'Habitats Directive'). Annex II and IV of the EC Habitats Directive 92/43;
- Appendix II of the Bern Convention;
- The Wild Mammals Protection Bill, 1996;
- Wildlife and Countryside Act, 1981; and
- The otter is a UK Red Data Book species.

Otters are listed as Annex II species (present but not the primary feature for designation) for the Kinloch and Kyleakin Hills SAC, and are a qualifying feature of the Kinloch and Kyleakin Hills SSSI.

The National Biodiversity Network (2008) identifies Kyle Rhea as a location for otter sightings in the region on both shores, particularly between the ferry crossing and the lighthouse, and otters are recorded in Kyle Rhea on the following databases: Mammal records from Britain for the Atlas of Mammals (1993) with subsequent records, Scotland Otter Survey Database and HBRG Vertebrates (not badger) datasets (SNH, 2010). A Forestry Commission owned otter hide is present on the Isle of Skye (shown by a blue star on the above map) and overlooks Kyle Rhea from an elevated viewing platform. The Kylerhea Otter Haven has reported an increase in the otter population in the local area in recent years.

Other protected species

The NBN gateway does not identify the area to be important for great crested newts *Triturus cristatus*. Two records of badger *Meles meles* were made in the 10km surrounding the proposed study area. Suitable habitat for badgers is unlikely in the footprint of the proposed scheme. Badgers are protected under the Protection of Badgers Act 1992 and are also listed on Schedule 6 of the Wildlife and Countryside Act 1981 (as amended). Pine marten *Martes martes* are recorded within the Kinloch and Kyleakin Hills SSSI (SNH, 2002) and are protected under Schedule 6 of the Wildlife and Countryside Act 1981 (as amended). Pipestrelle bats *Pipistrellus pipistrellus* have also been recorded, and are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and the Habitats Regulations (1994), and are a UK BAP species.

Fauna

Red deer (*Cervus elephas)* and roe deer (*Capreolus capreolus)* are present within the Kinloch and Kyleakin Hills SSSI in small numbers. In addition, fifteen species of butterfly have been recorded from the site, this being a high total for a northern locality (SNH 2002).

Invasive species

The Skye and Lochalsh Biodiversity Action Plan identifies terrestrial invasive species to be present within the region, including Japanese knotweed (*Fallopia japonica)* and rhododendron *(Rhododendron ponticum).*

Local Biodiversity Action Plan

The Skye and Lochalsh Local Biodiversity Action Plan identifies several priority terrestrial and intertidal habitats and species of conservation interest encountered on the Isle of Skye and the mainland surrounding the proposed scheme. Of all the species listed in the Plan, otters are most likely to be encountered on the Kyle Rhea coastline.

4.4.2 Identification of potential risks

The exact potential risks associated with the terrestrial and intertidal habitats and species will be dependant on the cabling route, however it is assumed the turbines will be linked to the existing grid network which crosses the kyle in the north of the proposed study area and this will be further informed by ecological surveys.

Permanent physical loss of important terrestrial habitats and species in the footprint of any land-based supporting infrastructure may occur during its installation. Installation of linear features, such as cables, may additionally result in habitat severance and fragmentation.

Temporary disturbance of important terrestrial habitats and species in the footprint of any access routes, lay-down areas and construction compounds may occur during installation.

Temporary disturbance of important intertidal habitats and species in the footprint of any access routes, lay-down areas and construction compounds may occur during installation. It is assumed that directional drilling would take place back from the shore to connect the marine devices to the existing grid system, and therefore the greatest risk to intertidal habitats and species would be if equipment is brought to the location by sea and landed on shore.

Disturbance of otters in the vicinity of any access routes, lay-down areas and construction compounds may occur during installation and maintenance of the substation. The Scottish Wildlife Series publication 'Otters and development' is available from http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp

A number of factors combine to indicate that direct interaction with the turbines is unlikely, including the highly tidal environment at Kyle Rhea, the depth of water required for turbine installation, the depth at which the rotors operate, and the preference of otters to feed in shallower waters where the water velocity is calmer. Otters show a strong preference for multiple short dives in shallow waters of 0-3m of depth, with evidence suggesting deep dives are less successful for catching prey (Nolet *et al.,* 1993). Therefore, although otters may cross the strait at Kyle Rhea, it is unlikely they would dive in the deeper water in search of food, and interact with the turbine rotors.

4.4.3 Methodology and approach to EIA

Data Requirement	Method	Data Sources
Existing marine ecological data (desk based)	Collation and review of any previous records or data relating to the presence of protected habitats and species	Highland Council Local Biodiversity Action Plan; National Biodiversity Network; Scottish Wildlife Trust; SNH
Identification of principal communities and habitats across site of terrestrial onshore works (field study)	For method see Phase 1 Habitat Survey Handbook, Joint Nature Conservation Committee (2007). Survey findings used to identify the requirement for any further detailed surveys.	JNCC SNH Commissioned survey
Identification of principal communities and habitats across	For method see Marine Monitoring Handbook, Davies *et al.,* (2001). Survey	JNCC SNH

Data Requirement	Method	Data Sources
site of intertidal onshore works (field study)	findings used to identify the requirement for any further detailed surveys.	Commissioned survey
Presence, distribution and abundance of otters within Kyle Rhea (desk based and field study)	Collate information on the presence, location and abundance of otter holts within Kyle Rhea. Undertake a visual inspection of the intertidal area in proximity to the cable landfall and substation. Look for the presence of holts or spraints	SNH - Scotland wide otters surveys (1977-79; 1984-85 and 1991-94). (JNCC website) FRS Kylerhea Otter Haven Commissioned survey
Presence, distribution and abundance of protected species and terrestrial invasive species (field study)	Walkover survey findings used to identify the requirement for any further detailed surveys.	JNCC SNH Commissioned survey
Potential Appropriate Assessment for otters (desk study)	The decision for if this is required would be made by SNH	SNH

4.5 Marine Mammals and Reptiles

4.5.1 Existing Environment

Cetaceans

All cetaceans found within the UK, including Scottish Waters, are protected by national and international legislations, including the Habitats Directive and the UK Biodiversity Action Plan (UK BAP). Species encountered around Skye and Lochalsh include (Highland Council, 2003):

- Northern right whale;
- Minke whale;
- Common dolphin;
- Risso's dolphin;
- Atlantic white-sided dolphin;
- White-beaked dolphin;
- Humpbacked whale;
- Harbour porpoise;
- Striped dolphin;
- Bottlenose dolphin; and
- Northern bottlenose whale.

The Cetacean Atlas (Reid *et al.* 2003) confirms the presence of these species in the waters around Skye however it also suggests the Fake killer whale, Cuvier's beaked whale and long finned pilot whale may also be present in the surrounding area. Hammond *et al.* (2006) state that species regularly occurring within the SEA 5 area (which encompasses Kyle Rhea) are harbour porpoise, white-beaked dolphin, Atlantic white-sided dolphin, killer whale, bottlenose dolphin and minke whale.

Pinnepeds

Grey seals *Halichoerus grypus* and harbour seals *Phoca vitulina* are Local Biodiversity Action Plan (LBAP) species around Skye and Lochalsh (Highland Council, 2003). Records of seals within Kyle Rhea, between 2002 and 2005, show sightings of up to four grey seals and up to fifty harbour seals (National Biodiversity Network, 2008).

The Ascrib, Isay and Dunvegan SAC is located to the north west of Skye, approximately 70km from Kyle Rhea. The complex of skerries, islets, undisturbed mainland shores and offshore islands consistently support a breeding colony of the harbour seal *Phoca vitulina*. The site represents one of the larger discrete colonies of harbour seals in the UK, holding around 2% of the UK population (JNCC, undated b).

Reptiles

The leatherback turtle is listed as a UK BAP species which occurs in Skye and Lochalsh (Highland Council, 2003). In 2003 and 2004 records of turtles (unknown species) from either sighting or strandings events were made at Tiree and in 2005 at Rum. In 2004 Loggerhead turtle sightings were made near the southern tip of Skye and in 2006 in the Sound of Sleat (Penrose 2005 and 2007).

4.5.2 Identification of key issues

Disturbance from increased human activity could displace seals from any haul out, breeding or moulting sites in the area, however shore based Marine Mammal surveys for the SeaGen turbine currently deployed in Strangford Lough show no evidence that increased human activity is causing a change in the seal abundance in the surrounding area (Royal Haskoning, 2009).

Noise associated with installation activities and operation of the tidal array could influence the normal activities of marine mammals. Many species of marine mammal use sound for detection of prey, communication and navigation. An increase in noise levels can mask biological acoustic cues used for hunting and social activity. There is a lack of data relating to the effects of small-scale drilling operations on marine mammals, however, baseline data from the SeaGen tidal turbine in Strangford Narrows, Northern Ireland, indicate that the low level drilling noise is unlikely to disturb marine mammals unless they come within close vicinity of the drilling operations (Nedwell & Brooker, 2008).

During the operational phase of the turbine site, noise and vibrations may result from the turbines and the periodic increase in vessel activity during maintenance. The impact of noise from the project on marine mammals within Kyle Rhea will depend on the levels of existing baseline noise in the study area.

Collision with vessels associated with installation and maintenance of the array, as well as with the moving rotors during operation could cause physical harm and possible fatality to marine mammals. The potential for collision is hard to predict due to the possibility that the mammals may be attracted to the array due to curiosity or aggregation of prey species.

Surveys of the Seagen turbine site in Strangford Lough showed low seal activity in the highly tidal area where the turbine is located (Royal Haskoning, 2009). The evidence from Strangford suggests that seals avoid the site during peak currents when the risk for collision would be at its highest. Seal activity around the Strangford turbine peaked during both high and low water slack (Royal Haskoning, 2009) when the turbine is rotating at it slowest.

The echolocatory and passive hearing of many marine mammals enables them to detect and catch prey, avoid predators and avoid obstacles in the water from substantial ranges. The low level noise and vibrations generated by the moving rotors may also help to alert mammals as to the presence of the rotors. The rotor tips will have a maximum velocity of 12m/s. Post mortems of all seal carcasses found in the Strangford Lough area have shown no trauma which can be linked to SeaGen after 1200 hours of operation (Royal Haskoning, in press).

In terms of potential collision with construction vessels there are no known recorded incidents of marine mammals involved in collisions with vessels associated with construction and maintenance of offshore wind farms.

Vessel collision with turtles is a possibility however due to the extremely low density of turtles expected in the area it is unlikely that vessels associated with the tidal array would collide with a turtle. Turtles spend most of their time in shallow waters foraging on jellyfish and basking in the sun and so interaction with the moving rotors is not expected.

Barrier effects caused by the tidal array could potentially interrupt the passage of marine mammals, particularly seals, through Kyle Rhea, between haul out sites and offshore foraging grounds however further investigation is required to establish whether any such routes exist. Passive sonar (TPOD) measurements from Strangford Lough indicate that harbour porpoise continue to pass through the narrows despite the presence and operation of SeaGen turbine. Telemetry and Marine Mammal Observation data also indicate that no barrier effect on seals has occurred within Strangford Narrows (Royal Haskoning, in press). The potential for the proposed Kyle Rhea array to cause a barrier effect to marine mammals may vary depending on the layout of the four turbines and while the monitoring results for SeaGen in Strangford Lough provide promising results, this impact will be need to be considered further during EIA.

Accidental release of contaminants, such as hydraulic oil, from vessels associated with the construction, maintenance and decommissioning and from the devices themselves as a consequence of operational failure could cause harm to marine mammals, particularly through accumulation through prey species.

4.5.3 Methodology and approach to EIA

Data Requirement	Method	Data Sources
Identification of marine mammal species and abundance data for Kyle Rhea and the surrounding area Spatial use of the area by marine mammals e.g. seal tagging data	Marine Mammal surveys including Marine Mammal Observation to JNCC standards, aerial surveys and tagging of seals. The methodology for baseline mammal surveys is discussed further in Appendix I.	Onshore seal data e.g. SCOS (2008) Cetacean Atlas (Reid *et al* 2003) Background information for SEA 5 (Hammond *et al.* 2004) Previous survey data e.g. SMRU Consultation with JNCC, SNH and SMRU.
Baseline Noise	Collection of real time noise data	Commissioned surveys

4.6 Natural fish and shellfish

4.6.1 Existing environment

The site of Kyle Rhea falls within the wider area of ICES rectangle[1] 43E4 (Figure 5.1). All species which were caught within and landed from this rectangle between 2004 and 2008 are shown in Table 4.2.

Table 4.2: Fish and shellfish species caught within ICES rectangle 43E4 between 2004 and 2009. Data Source: Marine Scotland.

Demersal and pelagic fish and Elasmobranchs		Shellfish
Cod *Gadus morhua*	Lemon sole *Microstomus kitt*	Edible crabs *Cancer pagurus*
Whiting *Merlangius merlangus*	Sprat *Sprattus sprattus*	Green crabs *Carcinus maenas*
Plaice *Pleuronectes platessa*	Megrim *Lepidorhombus whiffiagonis*	Velvet crabs *Necora puber*
Turbot *Psetta maxima*	Conger eel *Conger conger*	Crawfish *Palinurus elephas*
Haddock *Melanogrammus aeglefinus*	A number of Skate and Ray species: Likely to include the thornback ray *Raja clavata* and the cuckoo ray *Raja naevus*.	Lobster *Homarus gammarus*
Witch or right-eyed flounder *Glyptocephalus cynoglossus*		Nephrops *Nephrops norvegicus*
Monkfish (angler) *Lophius piscatorius*		Scallops *Pecten maximus*
Spurdog or spiny dogfish *Squalus acanthias*		Queen scallops *Aequipecten opercularis*
Ling *Molva molva*		Razor fish *Ensis ensis*
Pollack *Pollachius pollachius*		Squid
Saithe *Pollachius virens*		Whelks *Buccinum undatum*
Hake *Merluccius merluccius*		Mussels *Mytilus edulis*

Important fish species

Although unlikely to be targeted in the Kyle Rhea site itself, cod is an important exploited fish species in the North Atlantic and is widely distributed in the region particularly during summer. Spawning peaks occur during February and the proposed site lies within a cod nursery ground (Figure 4.2).

Herring, although not caught within ICES rectangle 43E4 are abundant in the summer and autumn, using the site and wider area for nursery grounds (Figure 4.2) and feeding throughout the western isles region.

Whiting, which are a UK BAP[2] species, are abundant and widely distributed within the North Atlantic. The northern part of the Kyle Rhea site, Loch Alsh and the Inner Sound form part of a large spawning ground (Figure 4.3) in which spawning occurs from about February to June (DTI, 2007).

Haddock are widely distributed in the western isle region and are present in large numbers in the summer and autumn. Spawning takes place between February and May, with a peak in March and April; the main spawning areas are outside the region in deeper water.

[1] The International Council for the Exploration of the Sea (ICES) has developed a grid system derived from degrees latitude and longitude that divides the seas into rectangles.

[2] The United Kingdom Biodiversity Action Plan (UK BAP) is the governmental response to the Convention on Biological Diversity signed in 1992. An action plan has been produced to conserve all UK BAP species.

Sprat, which is periodically abundant within the area, spawn across much of UK waters and are known to utilise the Kyle Rhea area (Figure 4.4).

Sand eels, which are not fished within ICES rectangle 43E4, spawn in an area approximately 12 km (in a straight line) southwest of the site. Sand eels are an important prey species for many sea birds (Section 4.3, Ornithology). They deposit their eggs on the seabed and are therefore sensitive to increased sedimentation and seabed disturbance. Spawning takes place from November to February (DTI, 2007).

Kyle Rhea is situated within a large saithe nursery ground which extends around much of the inshore waters of Scotland (DECC, 2009). Juveniles are located in inshore waters for 2-3 years before migrating offshore during spring to become adults (DTI, 2007).

Elasmobranchs

The elasmobranch family is made up of sharks, skates and rays and is characterised by a cartilaginous skeleton. This family is known to generally have a low resilience to exploitation and population decline as low numbers of eggs are laid compared to broadcast spawners. There is also greater potential for them to be affected by changes to the sedimentary environment as feeding and egg-laying are associated with the benthos.

The most abundant ray species in the area is the thornback ray, which has a mating and spawning period throughout summer. In addition, the spurdog, also known as the spiny dogfish, is found throughout the area and is the most frequently caught elasmobranch species in ICES rectangle 43E4.

The basking shark *Cetorhinus maximus* which is a UK BAP species is known to inhabit the waters around Skye (pers com. Hayes Turner; National Biodiversity Network, 2008) and consequently their presence within the Kyle Rhea site is possible.

Diadromous species

Rivers and coastal seas of Britain are known to support a number of diadromous (migratory between fresh and salt waters) species, specifically sea trout *Salmo trutta*, Atlantic salmon *Salmo salar*, eels *Anguilla anguilla* and the lamprey species *Petromyzon marinus* and *Lampetra fluviatilis*. Atlantic salmon and lamprey are Annex II species under the European Habitats Directive.

Atlantic salmon are known to use the rivers Glenmore and Glenbeg, which enter the Sound of Sleat approximately 2 km and 4km (respectively) south of Kyle Rhea (Gradiner & Egglishaw, 1986). Sea trout generally have a westerly distribution in Britain; however, it is not thought that any rivers and sea lochs in the vicinity of the proposed development are potentially important for sea trout. Eels are widespread across many river systems in Britain (Barne *et al*, 1997) and are therefore likely to be found in the region.

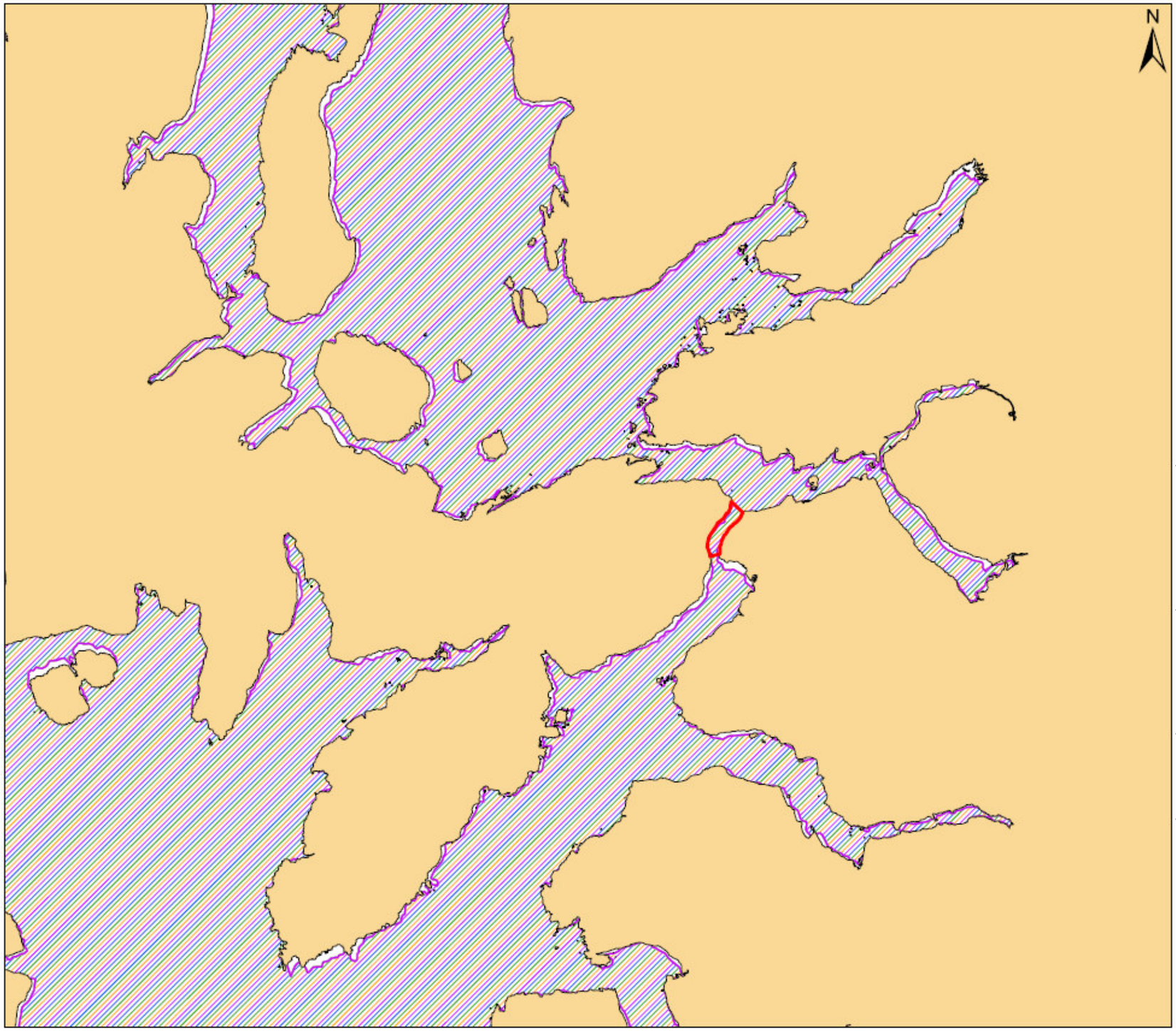
Shellfish and crustaceans

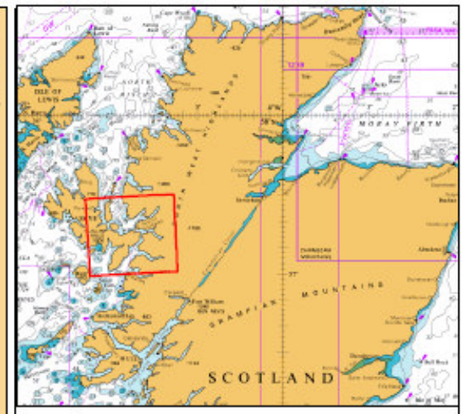
Nephrops is targeted within the region and make up a large portion of landings from ICES rectangle 43E4. In addition, Kyle Rhea falls within a large *Nephrops* spawning ground that extends from the North of Scotland to the Irish Sea (DECC, 2009), all though the kyle itself may not be locally important.

Shellfish resource exploitation within Kyle Rhea is thought to be restricted to fisheries for lobster and crab. Lobster is found on uneven ground close in to shore and around hard substrate features offshore.

Common species of crab such as edible, velvet and green are found on bedrock including under boulders, mixed coarse grounds, and offshore in muddy sand. Crabs are found extensively in lower shore, shallow sublittoral and offshore environments to about 100 m.

Kyle Rhea was designated as shellfish water in 2002 (SEPA, 2009) due to the presence of mussel beds, but was declassified in (Section 3.2 Water and sediment quality).





Legend:
- Proposed Site Boundary
- Nephrops Nursery Ground
- Herring Nursery Ground
- Cod Nursery Ground
- Saithe Nursery Ground

Title: FISH NURSERY GROUNDS

Project: KYLE RHEA TIDAL ARRAY

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Source data: CEFAS

Client: MARINE CURRENT TURBINES

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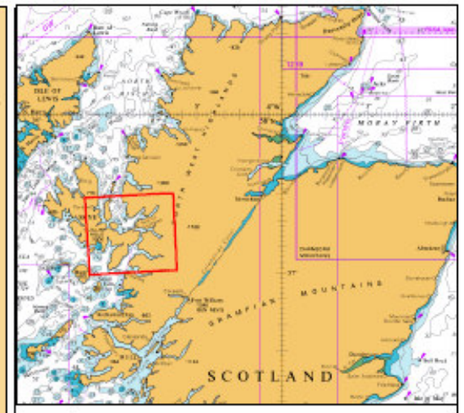
ROYAL HASKONING



Legend:

Proposed Site Boundary

Whiting Spawning Ground

Title:

UK BAP FISH SPAWNING GROUNDS

Project:

KYLE RHEA TIDAL ARRAY

Source:

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MARINE CURRENT TURBINES

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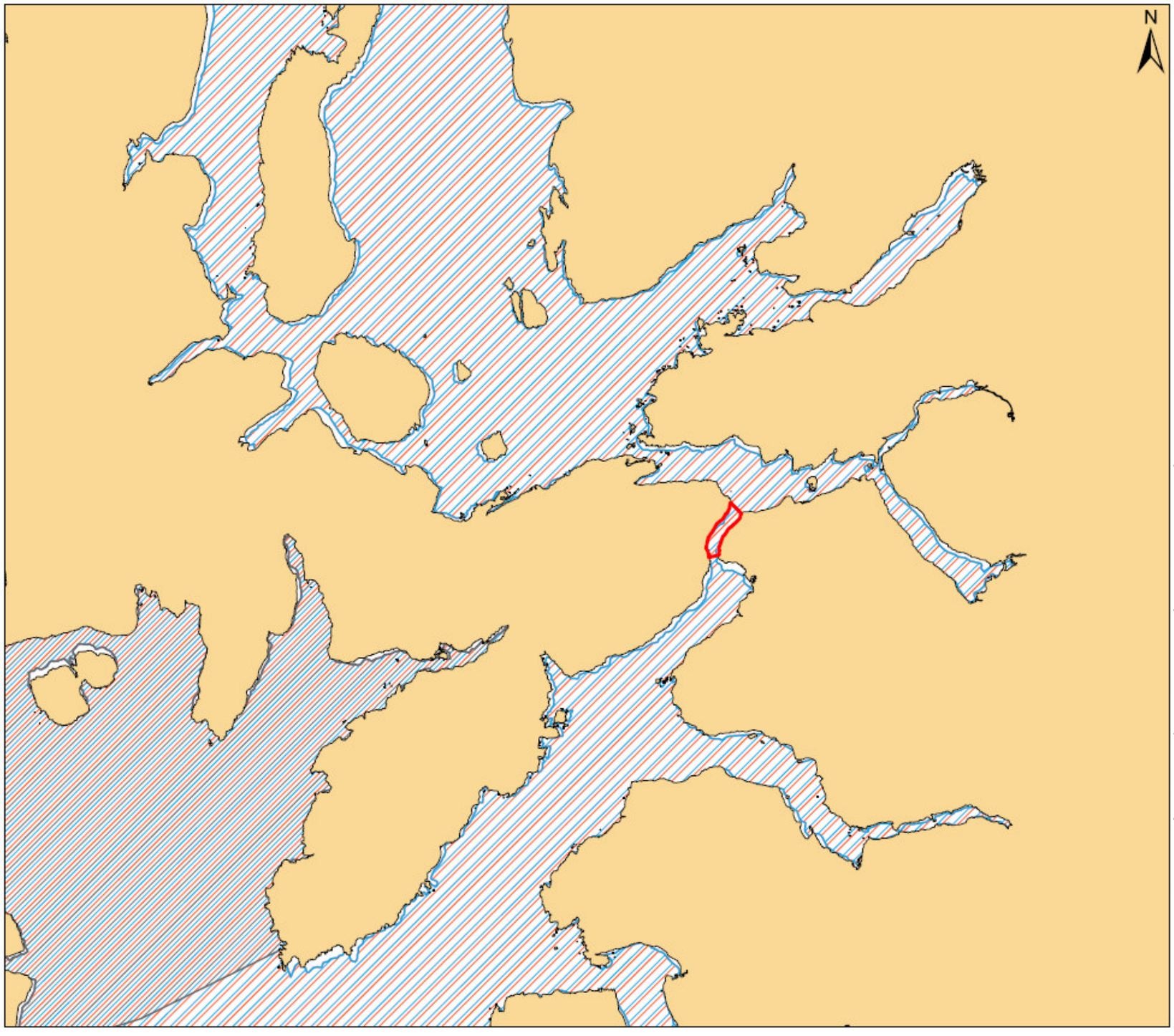
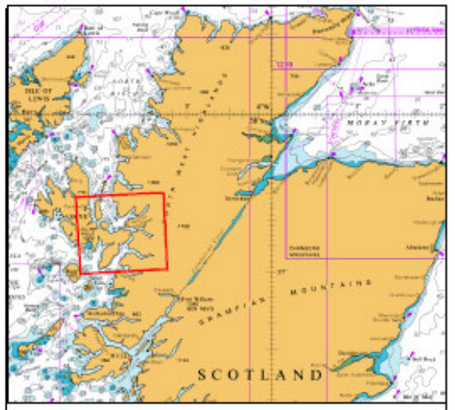
ROYAL HASKONING





Legend:
- Proposed Site Boundary
- Sprat Spawning Ground
- Nephrops Spawning Ground
- Sandeel Spawning Ground

Title:
NON UK BAP FISH SPAWNING GROUNDS

Project:
KYLE RHEA TIDAL ARRAY

Source:
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Client:
MARINE CURRENT TURBINES

Drawn by:	Checked:	Drawing No:
SKM	GB	9V5627/01/006

Date:	Figure:
23/02/2010	4.4

Scale:	Revision No:
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ROYAL HASKONING

4.6.2 Key Issues

Physical disturbance - Demersal fish and crustacean species may be prone to direct physical disturbance during the construction phase, especially where disturbance coincides with key spawning periods. The assessment will reveal the potential for this and, where necessary, mitigation measures will be investigated in order to minimise significant impacts.

Noise and vibration disturbance - An increasingly significant body of work has been carried out into the study of the effects of underwater noise upon sensitive fish species (Nedwell, *et al*., 2003; Parvin *et. al*., 2006). These studies have suggested that demersal spawning activity, by hearing specialist species such as herring, can be disrupted (and eggs damaged) through the noise and vibration effects associated with the construction of offshore wind farms. Hearing specialists that may be present in the area include the sprat and herring, which are known to be sensitive to noise disturbance. The significance of this impact during construction would be dependent upon the foundation type used and the method of its installation of the tidal array. Noise and vibration generated during construction may be generated by a number of sources including, vessels activity, pin piling, directional drilling and positioning of the structures. During operation noise and vibration may be created by turbine rotors and by electric cables.

Suspended sediments - Suspended sediments generated through the construction activities have the potential to impair respiratory or reproductive functions, or disrupt migration/spawning activity in sensitive species of both fish and crustacea. Juvenile/larval stages are most likely to be susceptible to such effects as they are less mobile and may not be able to avoid areas of high turbidity (ABP Research, 1997). It is not anticipated, however that significant quantities of sediment would be brought into suspension (against natural background levels) as a result of construction given the use of appropriate engineering solutions.

Loss of habitat: The physical presence of foundation pieces represents a permanent loss of habitat within a small footprint of 3.1m^2. The significance of this effect would be dependant upon the presence of a species of fish and/or shellfish that is dependant upon the habitat in question and that have a limited distribution of such habitat within the wider study area.

Effects of electromagnetic fields (EMF): EMF is thought to affect elasmobranch species in particular. Recent research concluded that the response of Elasmobranchs to EMF is not predictable and appears to be species specific and perhaps individual specific, meaning that some species and their individuals are more likely to respond by focusing movement within the zone of EMF than others (Gill *et al.,* 2009).

Cod, plaice and Atlantic salmon have also been described as electrosensitive species. It is thought that certain species can detect EMF at up to several hundred meters (Gill *et al.,* 2009). COWRIE is continuing to investigate the effects of EMF produced by underwater cables. Directional drilling of the majority of cables is currently the proposed option for installation, therefore removing the effects of EMF as cables will be shielded by rock. There is however likely to be cables or lengths of cables associated with the array that do not have as high a level of protection.

Increase in diversity/number of individuals: The device foundations and any associated scour protection are likely to be colonised by marine organisms. On the basis of evidence from offshore wind farms, the array structure may also act as a refuge for some fish species (Linley *et al*, 2007) providing shelter and food.

4.6.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Observer trips	Close liaison with fishermen should enable an observer to be present on fishing trips conducted by any fishermen that target Kyle Rhea.	Local fishermen.
Underwater noise survey (field study)	Assessment of baseline noise levels in relation to ferry and vessel movements and other activities.	Highland Council Ferry operators
Assessment of noise during construction and operation	A study to determine the levels of construction and operational noise/vibration compared to existing background levels to allow a full assessment of impacts on fish and shellfish resources, as well as other marine interests	Based on Seagen and Sea flow devises
Confirmation of spawning activity, nursery areas and salmon and sea trout migratory routes	Consultation	Local fishermen, the District Salmon Fisheries Board and Marine Scotland

5 HUMAN ACTIVITIES

5.1 Seascape / landscape

5.1.1 Existing Environment

The seascape of sounds on the west coast of Scotland, including around Skye is characterised by long linear views of water sandwiched between opposite land masses providing highly scenic landscape created by the variety of views experienced against the sea The association with lone peaks and jagged skyline often heightens the sense of reduced scale and accompanies the sense of enclosure. Scattered or linear pockets of settlement also contribute to the sense of remoteness and tranquillity of this seascape. The settled nature and containment of this type of linear seascape can bring with it a sense of calmness. Attention is focused less on open sea and more on narrow stretches of water, contrasting with steeply rising landform and often indented coastal edge. In particular, still and deep stretches of water, mirror-like reflections further enforce the quiet nature of the seascape as opposed to open and wild stretches of coast. (Scottish Exec, 2007)

The Knoydart National Scenic Area (NSA), around 15km south of the proposed array site has outstanding scenic value derived from the penetration of sea lochs deep into remote and rugged mountains. The extensive coastline contributes significantly to the character of the area, as do the deep glens carved between high peaks, with the intervening ground broken by rocky crags (Countryside Commission for Scotland, 1978). National Scenic Areas are designated for being “the very best” of Scotland’s natural beauty and amenity and are protected under the National Scenic Areas (Scotland) Regulations, 2008. It is not expected that the tidal array will be visible from the Knoydart NSA due to peaks of around 500m between the NSA and Kyle Rhea.

Kyle Rhea is narrow and contained by steep sides with large areas of coniferous forest on both sides of the strait. As a result the view of the kyle is largely restricted from many nearby locations. The visual aspect of human activity in the area currently include ferry activity during the summer months (see section 5.3, Shipping and Navigation), settlements to the south of Kyle Rhea, including Glenelg and Kylerhea, and Forestry Commission land.

5.1.2 Identification of Potential Impacts

The tidal devices proposed for the Kyle Rhea array will consist of a tower protruding to a maximum height of approximately 10m above the water surface (during Mean Sea Level). The devices will be marked and lit in accordance to advice from the MCA and Trinity House. This may intrude on the current visual character of the existing seascape, although there are navigation markers and lights already within the Kyle. Due to the relative containment of Kyle Rhea with steep sides it is not expected to be impact on the majority of the surrounding area.

The array will also introduce activity, including additional shipping which is out of keeping with the remote nature of the landscape.

5.1.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Existing landscape/ seascape character assessment	Review of published landscape and seascape character assessments and planning policies to establish baseline landscape and seascape conditions.	Guidance on Assessment of Impact of offshore windfarms (DTI, undated) Skye & Lochalsh Landscape Assessment (Stanton, 1996)
Seascape/ landscape sensitivity assessment	Professional judgement and possible use of Zone of influence modelling.	Guidance on seascape/ landscape capacity for Aquaculture (SNH, 2008)

5.2 Commercial fisheries

5.2.1 Existing Environment

Kyle Rhea is located within ICES[3] Division V1a – west Scotland and falls within ICES rectangle 43E4 (Figure 5.1).

Vessel Monitoring System (VMS) data form 2005-2007 indicates that fishing effort within Kyle Rhea and much of the surrounding area is considered low in a national context. Areas of high fishing effort do exist to the north and to south of the site at a distance of over 5km (Figure 5.1).

A number of fishing harbours and ports exist along the western coast of Scotland. The main administrative ports in the region of Kyle Rhea are Mallaig and Portree. Mallaig (approximately 25 km from Kyle Rhea) is the closest administrative port to the study area and is therefore more likely to administer vessels that will use Kyle Rhea.

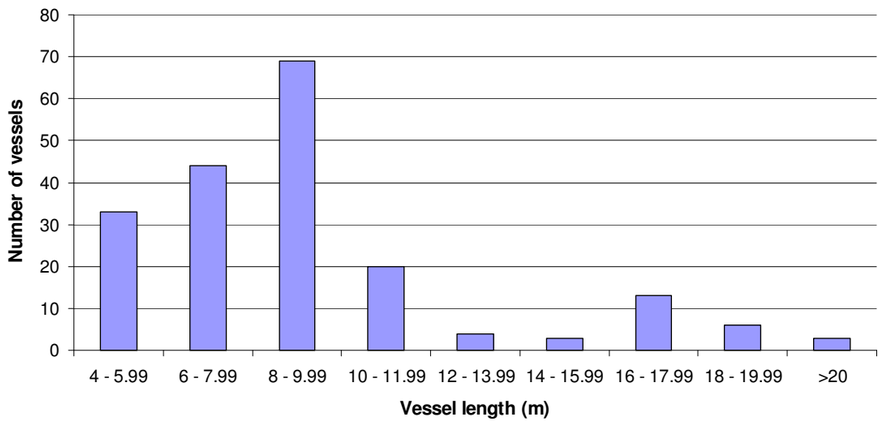
There are 147 vessels under 10m registered to Mallaig and Portree (17 of which have their home port in Kyle of Lochalsh the closest port to Kyle Rhea) and 104 vessels over 10m (4 of which have their home port in Kyle of Lochalsh). Table 5.1 gives a breakdown of the numbers associated with each port.

Table 5.1: Vessels registered at the closest Administrative ports to the study area (MFA, 2010)

Vessel length category	Administrative port		Totals
	Mallaig	Portree	
Under 10	29	118	**147**
10 meters and over	26	22	**48**
Totals	55	140	**195**

These vessels have an average registered tonnage of 17.38 and power of 98.99 kW. The average vessel age is 24 years, with 39% being built after 1990. The vessel profile in relation to length is shown in Graph 5.1. The majority of vessels (88%) are under 15m in length, with 75% under 10m. Typically vessels of this size will normally operate as day boats targeting inshore waters.

[3] International Council for the Exploration of the Sea



Graph 5.1 Length profile of commercial fishing vessels registered to Mallaig and Portree (MFA 2010)

Scottish Sea Fisheries Statistics (Scottish Government 2008) report that 95% of active Scottish based vessels under 15 m target shellfish using the following fishing methods:

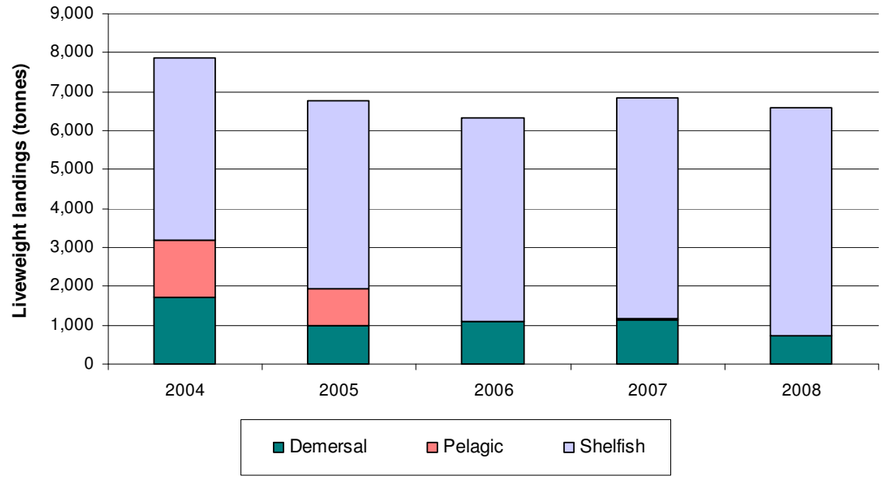
- Creel fishing (80%);
- Nephrops trawl (11%);
- Mechanical dredging (2%);
- Shell fishing by hand (2%); and
- Suction dredging (0.2%).

The most common fishing method practised by Scottish under 15 m vessels is creel fishing. To a lesser extent, demersal species such as cod, haddock, monkfish and dogfish are targeted using single trawls, lines and gill netting.

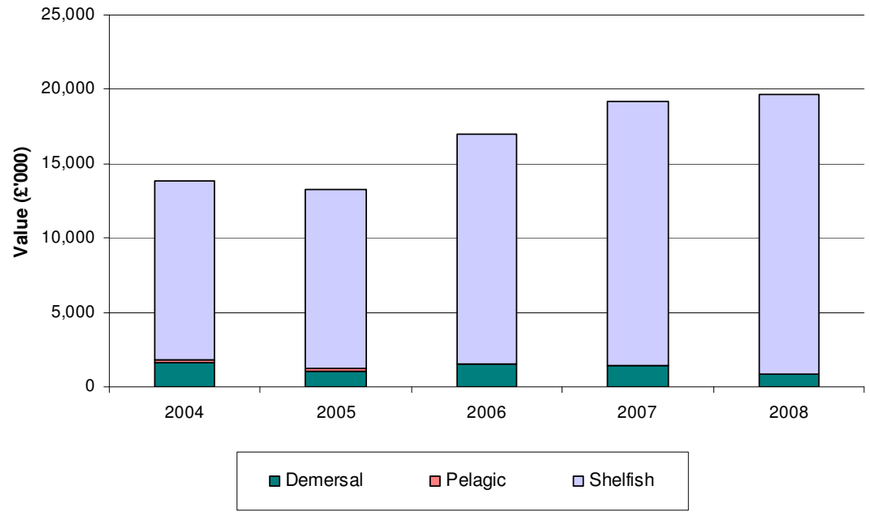
Creels or pots are usually set in 5-40 m of water, although this is dependant on the location being fished. Baited creels are generally strung together on a lead line of up to 20, but can also be set in smaller numbers or singularly. Pots are used to target crustaceans including lobsters and different species of crabs (edible, velvet etc), as well as *Nephrops*.

Pots are generally left for 12 to 48 hours and then retrieved. On occasion, pots are left longer, but after around two days they no longer fish since the bait has deteriorated or been eaten. Furthermore, any crabs and lobsters retained within them may become aggressive and fight.

The total liveweight volume and value of landings into Mallaig and Portree are presented for 2004 to 2008 in Graphs 5.2 and 5.3. Landing volumes decreased from 2004 to 2006, but increased in 2007 decreasing again in 2008. The value of landings in 2008 increased by 42% from 2004, while the volume decreased by 16%. This increase in value is largely a result of the higher prices obtained for shellfish.



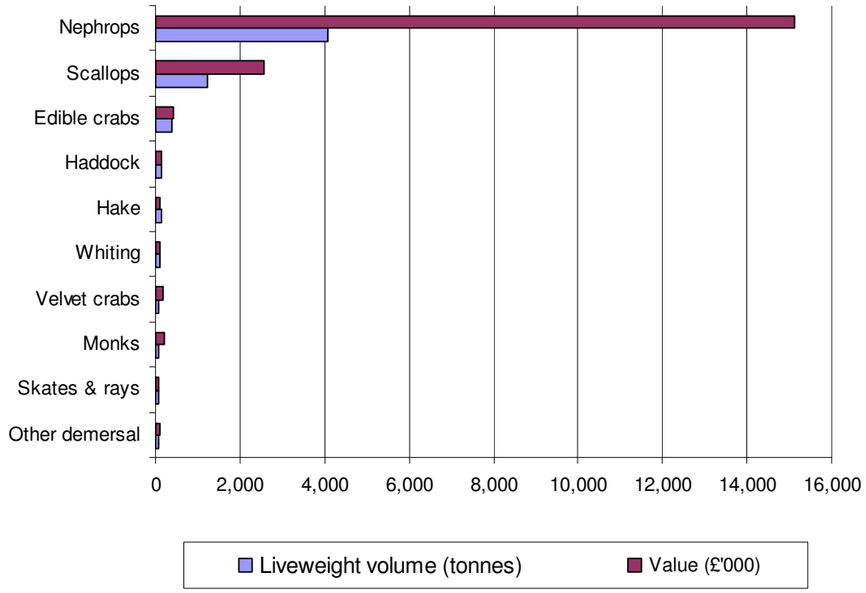
Graph 5.2 Liveweight volume of landings into Portree and Mallaig from 2004 to 2008 (Scottish Government 2008)



Graph 5.3 Value of landings into Portree and Mallaig from 2004 to 2008

Graph 5.4 presents the liveweight and value per species landed into Mallaig and Portree by UK vessels. Nephrops dominates the catch in terms of both weight and value. However, creel fishing is likely to be more common within Kyle Rhea and therefore species composition caught in this area will primarily be edible crabs, velvet crabs and lobster. This assumption is based on data published by Scottish Sea Fisheries Statistics (2008) and on benthic ecology and topography found in the Kyle Rhea. Further clarification and

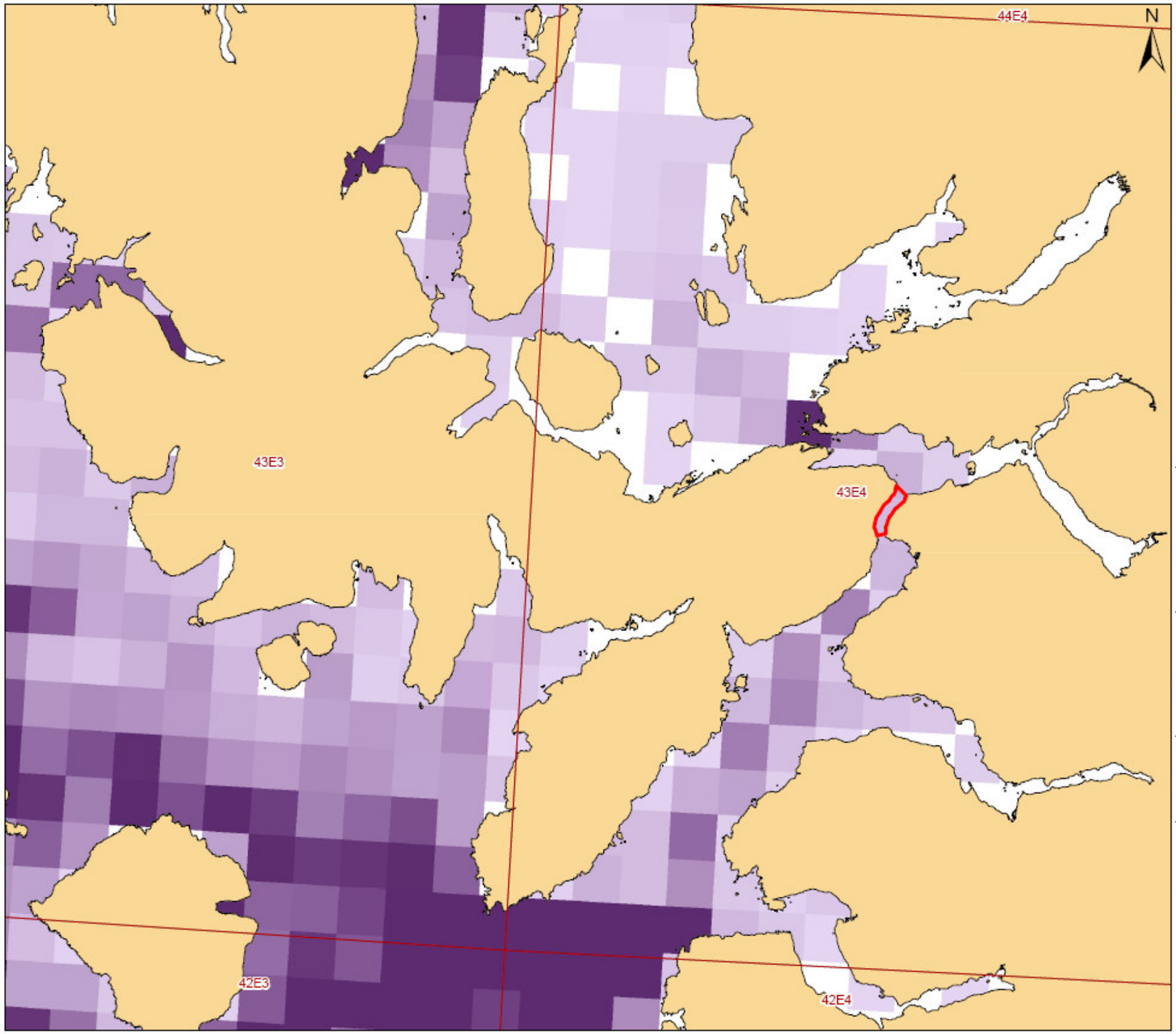
consultation will be required with local fishermen (please see Methodology and Approach to EIA section below).

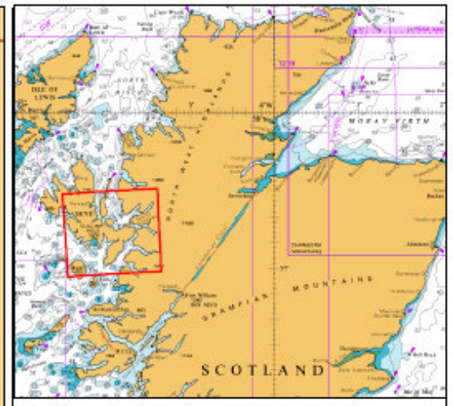


Graph 5.4 Liveweight volume and value per species landed into Portree and Mallaig in 2006

Fish farms

The wider area supports many fish farms; the closest known farm is located approximately 2km to the north west of the Kyle Rhea site at Sròn and Tairbh in Loch Alsh. This farm is operated by Marine Harvest Ltd and farms salmon.





Legend:
- Proposed Site Boundary
- ICES Rectangles
- UK Fishing Zone

VMS Total 2005-2007
- High : 7374
- Low : 1

Title:
COMMERCIAL FISHERIES

Project:
KYLE RHEA TIDAL ARRAY

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Client:
MARINE CURRENT TURBINES

Drawn by:	Checked:	Drawing No:
SKM	GB	9V5627/01/007
Date: 23/02/2010		Figure: 5.1
Scale: 0 1 2 3 4 5 Kilometres		Revision No: 001

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5.2.2 Identification of Potential Risks

Access to fishing grounds – Access may be restricted during construction of the tidal turbines and cable route. Certain types of fishing may be constrained as a result of the creation of physical obstacles (the turbines themselves) or for safety purposes.

Increased conflict over diminished grounds – Exclusion from one fishing area may increase fishing activity in other existing fishing grounds, thus increasing the intensity of effort in particular areas. Given the relatively low number of vessels likely to be affected by any potential removal of access from parts of the kyle, it is not anticipated that a significant impact on the local fishing industry would arise.

Loss or damage to gear – The normal practice of local fishing vessels hauling fleets (strings) of creels in highly tidal areas raises a risk of entanglement of a fleet of creels in the blades of the turbine whilst the fleet of creels is being winched to the surface. The risk of entanglement will be low given the limited use of the area for fishing. The site will also be clearly marked and turbine rotors will be fitted with rope cutters close to their hub further reducing the risk of entanglement.

5.2.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Fisheries landing statistics (desk based)	Data will be assessed for ICES rectangle 43E4 to provide information on local ports, species landed, fishing activity, seasonality and economic value of catches from within the site and adjacent areas.	Sea Fisheries Division of Marine Scotland, The Inshore Fisheries Group Local Sea Fisheries Committees. Fisheries Research Services ICES
Commercial VMS (Vessel Monitoring System) data (desk based)	Data will be speed filtered[4] and assessed in relation to fishing effort within the study area and will be plotted using GIS. This will allow the presence of important fishing grounds to be determined, should they exist.	Sea Fisheries Division of the Scottish Government
Consultation pre consent (desk based and on location)	Detailed, early and well-targeted consultations with commercial and recreational fishermen, fishing organisations and the relevant local fishery management organizations will further support the baseline description of the fishing activity (in terms of fishing effort, area of activity, target species and commercial value).	Marine Scotland The Scottish Fishermans Federation Local Fishermen's Association(s) such as the Highlands & Islands Fishermen's Association, Mallaig & North West Fishermen's Association
Consultation post consent (desk based and on location)	A Fisheries Liaison Officer will be used to facilitate discussions with local fishermen as well as advise when surveys are taking place in order to ensure minimal disruption to fixed gear.	Local Fishermen's Association(s)

[4] The speed filtering process identifies fishing vessels which, based on their speed of travel, are likely to be actively fishing (i.e. if they were travelling more slowly they would be near-stationary, and if they were travelling faster they would be steaming)

5.3 Shipping and Navigation

5.3.1 Existing Environment

Anatec data shows commercial shipping density, including ferries, tankers and cargo vessels in Kyle Rhea to be very light (0-10 vessels per cell, approximately 16.5nm^2). Very heavy (greater than 1000 per cell) shipping density is recorded in the Little Minch, to the north west of Skye and to the south of the Kyle Rhea, in the Sound of Sleat and mouth of loch Nevis (DECC *et al,* 2009). This is supported by Marico Marine (2007) which states that the area to the north of Skye, off Rubha Reidh, has significant vessel traffic.

MCT has recently commissioned vessel surveys for the study area and Figure 5.2 shows AIS and radar tracks of vessels passing through Kyle Rhea. During a 14 day survey period in March 2010 94 vessel tracks were recorded.

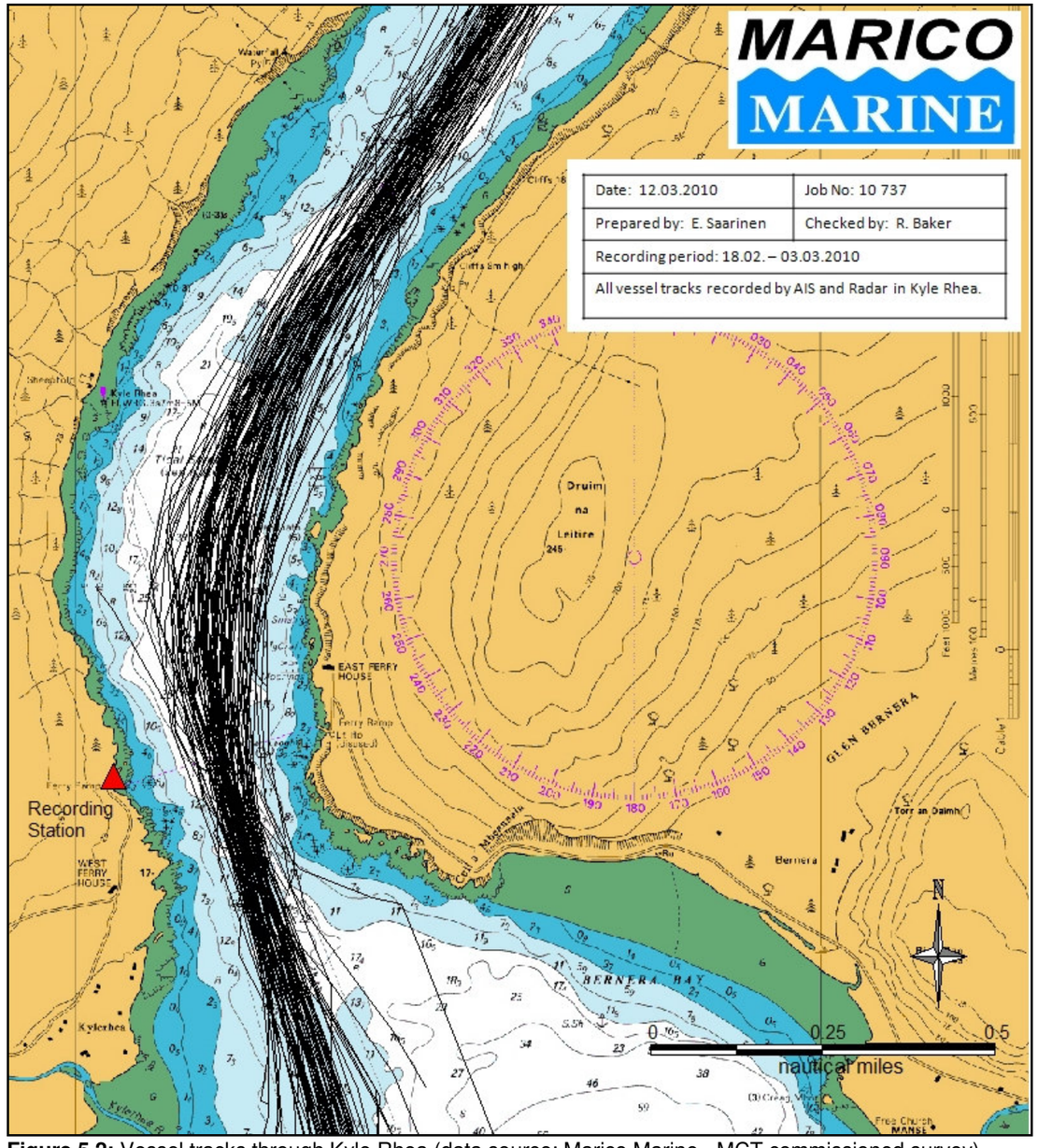


Figure 5.2: Vessel tracks through Kyle Rhea (data source: Marico Marine - MCT commissioned survey)

Recreational use through Kyle Rhea is heavy (DECC, 2009). Kyle Rhea is encompassed by an RYA UK sailing area. These are areas in extensive use for general day-sailing by all types of recreational craft but particularly smaller craft such as small cruisers, day-boats, dinghies, sailboards and personal watercraft. Such craft will not normally be undertaking point-to-point passages but will be on out and return activities and may appear to be sailing in random directions as they take advantage of wind and tide to make progress. (DECC, 2009)

A small ferry crosses Kyle Rhea in the summer only (June, July and August).

An RNLI lifeboat station is present at Kyle of Lochalsh, approximately 7km from Kyle Rhea. The station was established in 1995 to supplement the support from the lifeboat stations at Mallaig and Portree following a significant increase in recreational sea use in the area.

5.3.2 Identification of Potential Impacts

Displacement of vessels from the usual shipping route: The possible exclusion of vessels travelling through Kyle Rhea for safety purposes during construction would cause increased journey times and distances. The introduction of installation vessels and equipment in the study area will require vessels to move around the construction activities potentially increasing journey times, distances and cost.

Collision risk: Increased vessel numbers within Kyle Rhea (and the surrounding area during transit of the devices and installation/ maintenance equipment) will increase the risk of collision between vessels. Visibility and the ability to manoeuvre freely are important to safe navigation and the requirements of installation in terms of vessel movements, anchoring and manoeuvring will need careful; management.

Collision of vessels with the installed array is unlikely as the towers will provide a prominent structure, painted with the appropriate marking and fitted with navigation lights.

Disturbance to search and rescue: Search and rescue exercises and operations could be needed at any time throughout the study area and the planning for such activity may need to be adapted if construction activities restrict access through and to Kyle Rhea. In particular, the ability of the Lochalsh lifeboat to operate must not be impaired and MCT would agree an appropriate approach to management of installation works with RNLI to ensure this was the case. A similar requirement was successfully managed with RNLI support during the installation of the SeaGen turbine in Strangford Lough, where the Portaferry lifeboat similarly required passage through a tidal narrows during installation.

It is not expected that the tidal array will impact use of radar for navigation and the minimum depth of 3m will allow passage of small vessels, of the size expected to use a narrow strait, directly over the rotors.

5.3.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Navigational review (desk based)	A navigation review will include consultation with relevant stakeholders e.g. MCA and Northern Lighthouse Board to assess shipping density in the area	Consultation with relevant stakeholders e.g. RYA and RNLI (see section 7.2, Consultation strategy)
Navigation survey	A survey of vessels passing through Kyle Rhea was commenced in March2010	Commissioned survey
Navigational Risk Assessment	Undertake Preliminary Hazard Analysis (PHA) to inform detailed siting of devices and agree scope of full navigation assessment, if required, with MCA in accordance with MGN 371 (formerly MGN 275).	MCA

The EIA will provide mitigation to ensure minimal impact and maintain safety for all shipping activities.

5.4 Onshore Traffic and Transport

An airport is present at Broadford on the Isle of Skye, approximately 15km from Kyle Rhea (see section 5.9, Airtraffic). There is a small road running along Glen Arroch from the airport to Kyle Rhea.

On Skye, a small (non-graded) road runs from the Kyle Rhea ferry to the A87 near Broadford. On the mainland a small road runs from Kyle Rhea ferry along the coast to Galltair. A network of small (non-graded) roads is present in this area, joining up with the A87 in the east, near the head of loch Duich. The A87 crosses from the mainland to Skye at Kyleakin.

5.4.1 Potential Effects

Disruption to local traffic and access may occur during installation and maintenance of the tidal array, however, this is expected to be limited. The nature, duration and magnitude of effects will depend upon the methods by which construction materials and plant are transported to site, however, at present most transport is expected to be by sea. The effects are therefore discussed in more detail in section 5.3, shipping and navigation.

Some additional human activity in the area associated with the project may contribute to the local traffic however this is not anticipated as being of sufficient scale to cause any significant disruption.

5.4.2 Methodology and Approach to EIA

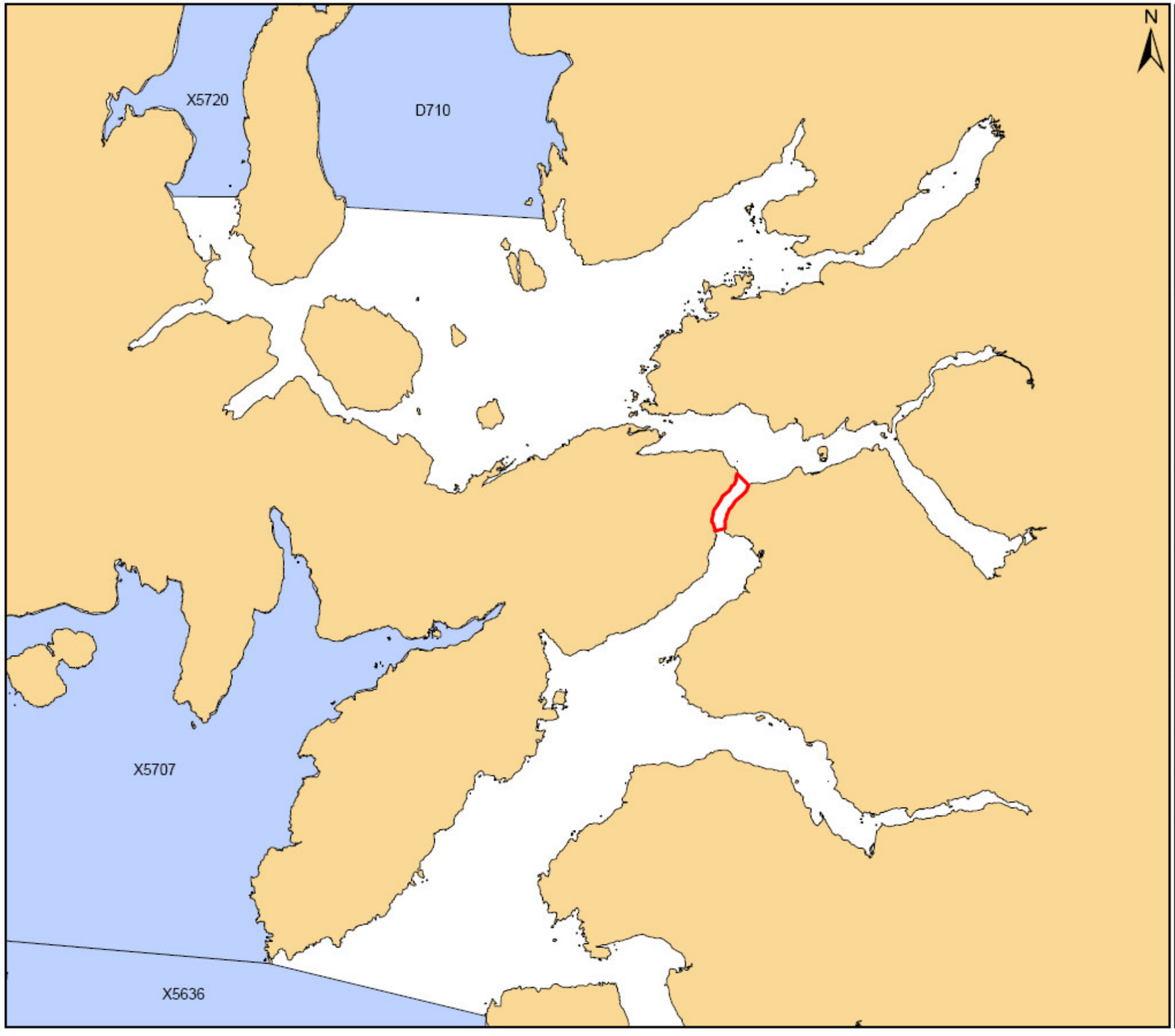
Onshore traffic is not predicted to be affected by the proposed array and so this parameter will be 'scoped out' and not included further within the EIA. The ES will outline route options for all transport requirements and if this includes significant onshore transportation then the impacts will be considered further.

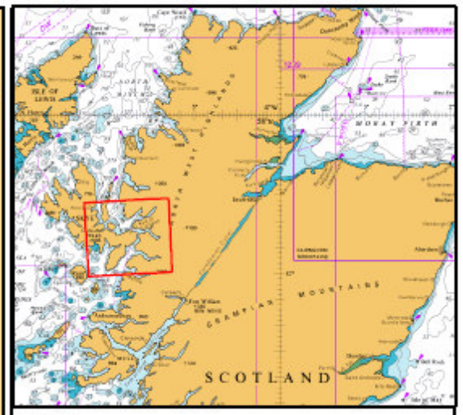
5.5 Military Activity

5.5.1 Existing Environment

Western Scotland has large areas designated as military practice and exercise areas (PEXA). Kyle Rhea is not located within a PEXA, with the nearest (D710) approximately 20km away at the Inner Sound, between Raasay and mainland Scotland (Figure 5.3). The Royal Navy's British Underwater testing and Evaluation Centre (BUTEC) is located in the Kyle of Lochalsh and military activities, including military diving are carried out in the area (EMU Ltd, 2006).

Marico Marine (2007) shows naval vessel movements to the north west of Kyle Rhea, in the Inner Sound and to the south of Kyle Rhea, in the Sound of Sleat. No naval routes are shown through Kyle Rhea.





Legend:
- Proposed Site Boundary
- Military Practice and Exercise Areas (PEXA)

Title: MILITARY ACTIVITY

Project: KYLE RHEA TIDAL ARRAY

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Date:	Figure:
23/02/2010	5.3

Scale: 0 1 2 3 4 5 Kilometres

Revision No: 001

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5.5.2 Identification of Potential Impacts

Transportation of equipment and materials may be required through the PEXA areas to the north or south of Kyle Rhea; however, no long term disruption is expected.

Acoustic output associated with the tidal devices could potentially have effects upon military sonar, though there is no evidence available to suggest such an impact will arise. (Scottish Executive, 2007)

5.5.3 Methodology and Approach to EIA

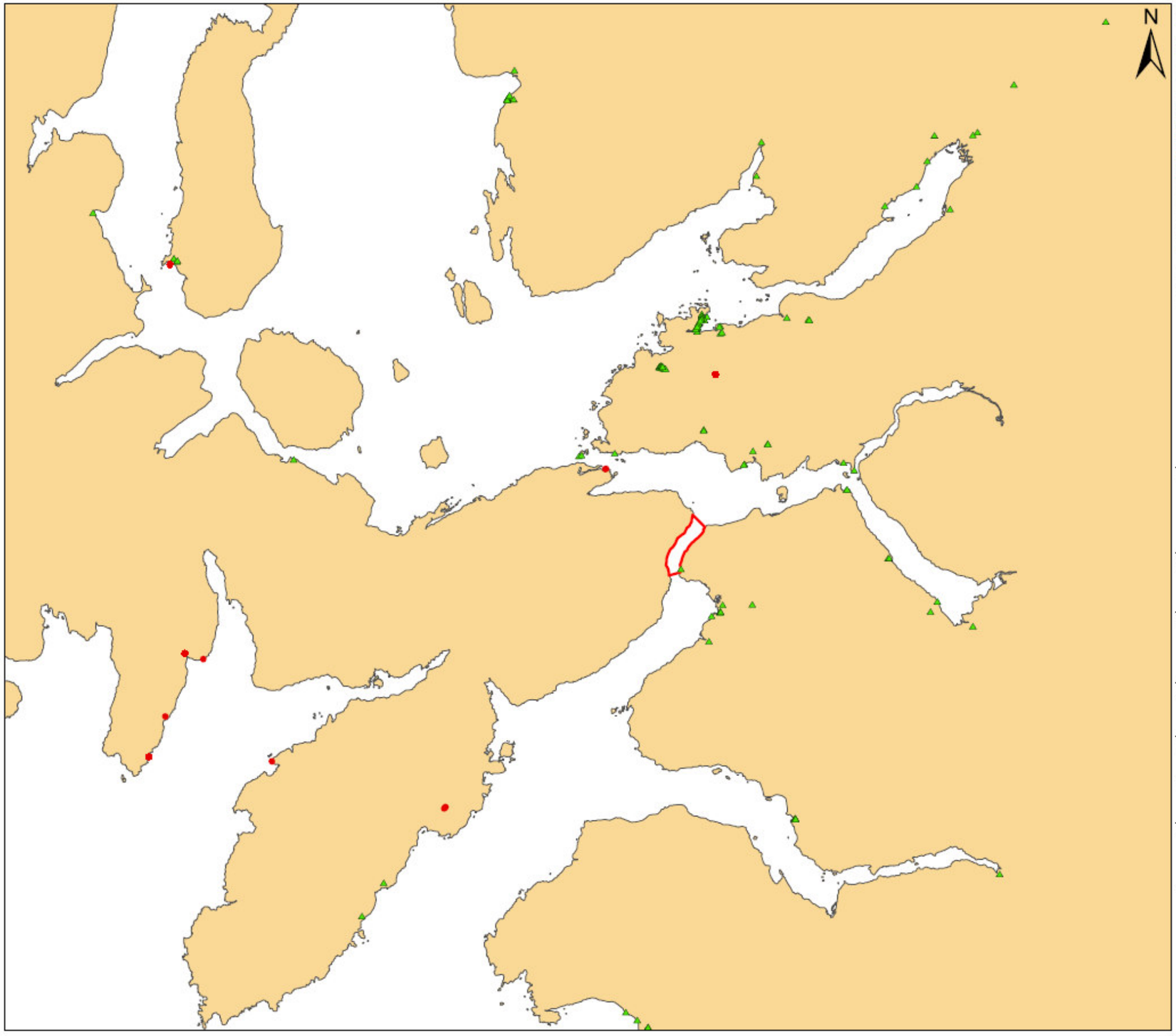
Data Requirement	Method	Data Sources
Local military activity	Consultation with relevant stakeholders	Ministry of Defence

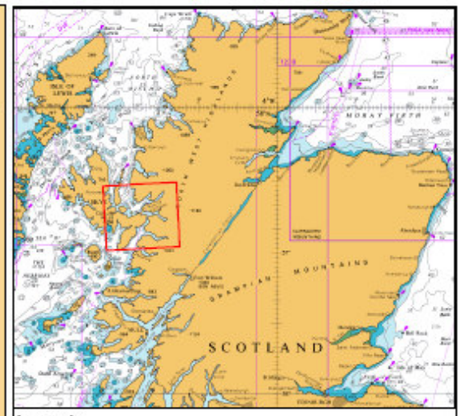
5.6 Archaeology and Cultural Heritage

5.6.1 Existing Environment

The Kylerhea Old Ferry Inn on the mainland side of Kyle Rhea is a category B listed building (Figure 5.4). The Kylerhea pier and Kylerhea lighthouse are national monuments. No scheduled monuments are listed in the Kyle Rhea area (RCAHMS, 2008).

Within the site boundary eleven possible wreckage events are listed but the exact position and outcome is not fully known. No existing wrecks are known within the site.





Legend:

- Proposed Site Boundary
- Scheduled Ancient Monuments
- Listed Buildings

Title: ARCHAEOLOGY

Project: KYLE RHEA TIDAL ARRAY

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5.6.2 Identification of Potential Impacts

None of the historical sites discussed above will be impacted by the proposed development.

Changes in tidal flow or wave energy could have beneficial effects on historic remains or sites where changes in sedimentation patterns lead to sites or remains being exposed, increasing opportunities for their discovery. (Scottish Executive, 2007)

5.6.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Assessment of current records for potential landfall sites	Desk based assessment using relevant guidance e.g. Institute of Field Archaeologists (2001). Consultation with relevant stakeholders	Consultation with Scottish Natural Heritage; Historic Scotland; Highland Council Archaeology Unit Sites and Monuments Record; lists of listed and locally listed buildings; historic maps;
Geophysical data to be collected during EIA	Review of any potential subtidal archaeological features shown on geophysical results.	Commissioned geophysical survey

Due to the lack of historical sites shown around the study area it is not anticipated that the development of a tidal array within Kyle Rhea will impact upon any archaeological sites. During EIA geophysical data will be collected and analysed for archaeological review of the geophysical data and at potential landfall sites. If any features of archaeological interest are found then this receptor will be considered further.

5.7 Noise

5.7.1 Existing Environment

There are few regular sources of anthropogenic noise in the study area however the ferry crossing Kyle Rhea will provide regular underwater noise during the summer months. The low level of commercial shipping discussed in section 5.3 will also contribute to subsea noise, however, the heavy recreational usage of the kyle is expected to be mostly sailing which will not provide significant subsea noise. The strong tidal flow and turbulent conditions will also provide some environmental background subsea noise.

On land, the site is expected to be quiet with little anthropogenic activities contributing to noise. The engines of the ferry may be heard in close proximity to the kyle and the low volume of traffic may provide a small amount of noise. Forestry Commission activities may cause infrequent, low level noise.

5.7.2 Identification of Potential Impacts

During construction noise disturbance from installation activities such as drilling as well as increased vessel traffic may cause disturbance to the surrounding community. During maintenance a low level of noise may be created, however during general operation noise levels should be insignificant.

Subsea construction noise data indicate that the levels of noise produced during construction of the SeaGen device in Strangford Lough are considerably lower than those that may cause fatality, physical injury or audiological injury to species of fish and marine mammal. The data also indicated that species of fish and marine mammal are unlikely to have been disturbed unless they were in close proximity to the drilling operation. It is unlikely that harbour porpoise were able to hear the drilling noise due to the levels of high frequency background noise in the Strangford Lough region masking the noise from the drilling operation (Nedwell & Brooker, 2008).

The operational noise of the SeaGen device in Strangford Lough at distances of 150m south and 311m north shows the device to be within similar hearing thresholds as the background noise for harbour porpoise. At these distances the device also provides noise within similar hearing thresholds for grey and harbour seals as at 50m distance from the ferry which crosses the Narrows from Strangford to Portaferry (Royal Haskoning, in press). These results suggest that in an energetic environment, with natural background noise as well as ferry and other commercial traffic, the potential impacts of noise may be limited.

The effects of underwater noise and vibrations on marine life are discussed in section 4.6 natural fish and 4.5 marine mammals.

5.7.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Assessment of sensitive on land receptors in proximity to the proposed array site in relation to predicted noise outputs.	Identify main settlements, private residences, and commercial buildings	OS map Highland Council
Subsea baseline noise measurements	Hydrophones to collect real time noise data	Commissioned survey
Subsea noise modelling based on Strangford measurements	Comparisons with baseline data at Strangford & Kyle Rhea and scaling up from one device to four.	Construction and Operation subsea noise reports for Strangford turbine

5.8 Tourism and recreation

5.8.1 Existing Environment

Recreational drift diving occurs through Kyle Rhea, however there are also many alternative dive sites in the area within lochs Duich, Long and Alsh and around Skye.

As discussed in section 5.3, Shipping and Navigation, Kyle Rhea is encompassed by a RYA UK sailing area leading to heavy recreational use of Kyle Rhea. A number of marinas are present in the area, including Broadford. RYA training centres are also present at Broadford and Kilbed (DECC *et al.* 2009).

Kyle Rhea is listed in the Visit Scotland (undated) Best Sea Kayaking in Europe website. It states that this is an advanced route with the tide reaching up to 7 knots creating waves and whirlpools.

The otter haven on the west shore of Kyle Rhea provides a hide to view otters and other wildlife. A picnic area and forest/ coastal paths also provide tourism and recreation attractions on the Skye side of Kyle Rhea. To the east, on the mainland, a path is present along the coast from the ferry slipway to Ardintoul Point.

5.8.2 Identification of Potential Impacts

Disturbance to recreational activity – Existing marine recreational activities, including sailing, sea kayaking and scuba diving within the Kyle Rhea study area would be displaced during construction of the

turbine array and possibly during operation if sea users perceive a danger relating to the turning rotors. The devices may also interrupt the view from the otter hide.

Indirect opportunities for local tourism –The tidal array may be viewed as an interest feature which has potential to attract tourists. The tourist information centre in Portaferry, Northern Ireland provides a display of the Seagen device in Strangford Narrows which can be used to educate members of the public. Since SeaGen's installation a number of tourists have requested visits to view the device from local vessel operators.

5.8.3 Methodology and Approach to EIA

It is not anticipated that any specific studies relating to effects on tourism and recreation will need to be undertaken, but as part of the EIA process, consultation with local recreational groups and bodies representing the local tourism industry will be carried out. This will allow key issues to be identified and the impacts of the Tidal Array construction, operation and decommissioning to be fully assessed and mitigation measures identified. Assessment of the effects on tourism and recreation associated with the visual impact of the turbine array would be supported by the findings of the Seascape and Visual Impact Assessment.

Data Requirement	Method	Data Sources
An account of local business and recreational operators within the area (desk based)	At an early stage of the EIA consultation, identify all marine and terrestrial stakeholders	Relevant stakeholders e.g. Highland Council; Visit Scotland; Otter haven (see section 7.2, Consultation Strategy)

5.9 Air traffic

5.9.1 Existing Environment

A military low flying tactical training area is located on the mainland approximately 15km from Kyle Rhea, in which flying is authorised to a minimum ground clearance of 100ft (30.5m) (MOD, undated). As this area does not encompass Kyle Rhea and with mountain peaks of around 600m between the edge of the tactical training area and Kyle Rhea it is not expected that flying activities would come into proximity with the tidal array.

Broadford airport on Skye is approximately 15km from Kyle Rhea and so air traffic could be at low heights close to the study area, however with mountain peaks of up to 739m (Sgurr na Coinnich) between Kyle Rhea and Broadford aeroplanes will be passing considerably higher than the maximum (with crossbeams raised) 20m height of the devices. During construction the height of cranes may be significantly higher, but should still be considerably lower than any anticipated overflying aircraft.

Additional air traffic passing over the study area at height may be travelling to Stornoway, Benbecula, Barra and Tiree airports approximately 100km from Kyle Rhea.

5.9.2 Identification of Potential Impacts

Collision with the array or construction equipment (e.g. cranes) by low flying aircraft is very unlikely given the low height in comparison with the surrounding mountain peaks.

Interference with radar is not expected to be caused by the tidal array.

5.9.3 Methodology and Approach to EIA

Airtraffic is not predicted to be affected by the proposed array and so this parameter will be 'scoped out' and not included in the EIA.

5.10 Socio-economics

5.10.1 Existing Environment

The Skye and Lochalsh local plan for the Glenelg, Arnisdale and Loch Hourn area (Highland Council, 1999), which encompasses Kyle Rhea states that there is a decline of employment in the area due to loss in crafting, forestry and estate work. Limited housing and poor road access have led to a decline in population and economic activity. In 1999 the Highland Council stated that they wished to encourage modest development to invest in the area which they predicted to contribute to a 9.2 % population increase by 2006.

Following a change in the area covered by the local plan to the Skye and Lochalsh area within the West Highlands and Islands Local Plan (Highland Council, 2008) a 4% increase in population was predicted. This rise is due to an increase in the anticipated level of migration to the area during the period from 2008 to 2018 because deaths continue to outnumber births. Future growth is also dependent on reducing outward migration (particularly of young people). This will also have the added benefit of sustaining local primary schools and other facilities.

5.10.2 Identification of Potential Impacts

Increased local employment opportunities and revenues would arise from the installation of a tidal array during the construction, maintenance and decommissioning stages. In Scotland it is anticipated that renewable energy projects could potentially create tens of thousands of jobs (Scottish Government, 2009). Pre-installation work such as site specific surveys could also be carried out by any suitably qualified local people.

Increased public spend would occur with the increase in human activity in the area. Personnel including engineers and scientists brought in to work on the array project would require food and accommodation throughout the year.

5.10.3 Methodology and Approach to EIA

Data Requirement	Method	Data Sources
Consultation (desk based and on location)	Consultation with key organisations to obtain specific information and data (e.g. local knowledge) and to discuss the potential impacts in relation to their organisations' interests	Highland Council; Scottish Enterprise; and Local businesses

6 CONCLUSION

The Environmental Statement of the EIA will assess the magnitude of all likely impacts and will identify appropriate mitigation to reduce impacts to an acceptable level. Table 6.1a and 6.1b outline the need for the potential impacts outlined in this scoping study to be considered further during EIA. In addition to the site specific environmental impacts outlined below there are significant beneficial impacts to the development of renewable energy technologies with regards to reducing carbon emissions and combating climate change.

Table 6.1a: Consideration of Effects Shown in Table 6.1b

✓	Potentially significant effect requiring detailed investigation in the EIA
✓	Effect significance unknown requiring further data to be collated and assessed
×	Effect unlikely to be significant (and therefore has been scoped out of EIA)
×	No effect (and therefore scoped out of EIA)
✓	Beneficial

Table 6.1b: Key Potential Effects of the Proposed Tidal Array

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Physical processes and geomorphology				
Effects on geological formations	×	×	×	×
Effects on geomorphology and sediment transport	✓	✓	×	×
Effects at the landfall location:	×	×	×	×
Effects on hydrodynamic regime:	✓	✓	✓	✓
Impacts to GCR sites:	×	×	×	×
Water & Sediment Quality				
Disturbance of contaminated sediments	✓	×	×	✓
Impacts on water and sediment quality:	✓	×	×	✓
Marine Ecology				
Physical disturbance	✓	×	×	✓
Habitat alteration	✓	✓	×	×
Habitat loss	✓	×	×	×
Increased suspended sediments	✓	×	×	✓
Smothering	✓	×	×	✓
Impact to integrity of designated sites	✓	✓	✓	✓
Ornithology				
Disturbance or displacement due to human activity and noise	✓	✓	✓	✓
Collision of diving birds with turbine rotors	×	✓	×	×
Loss of potential foraging habitat and food sources	×	×	×	×
Impact to integrity of designated sites	×	×	×	×
Terrestrial Ecology				
Permanent physical loss of important terrestrial habitats and species	✓	✓	✓	✓
Temporary disturbance of important terrestrial habitats and species	✓	×	×	✓
Temporary disturbance of important intertidal habitats and species	✓	×	×	✓
Disturbance of otters	✓	✓	✓	✓
Impact to integrity of designated sites	✓	✓	✓	✓
Marine Mammals				
Disturbance due to increased activity	×	×	×	×
Noise and vibration disturbance	✓	✓	✓	✓
Collision	✓	✓	✓	✓
Barrier effects	✓	✓	✓	✓
Accidental release of contaminants	✓	×	×	✓
Designated Sites				
Impact on LDA SAC is deemed to be significant and will be considered under the marine ecology section. It is unlikely that the array will impact upon other designated site in the surrounding area.				
Natural Fisheries				
Physical disturbance	✓	✓	×	✓
Noise and vibration disturbance	✓	×	×	✓

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Suspended sediments	×	×	×	×
Loss of habitat:	×	×	×	×
Effects of electromagnetic fields	×	×	×	×
Increase in diversity/number of individuals	×	✓	×	×
Seascape/ landscape				
Array	✓	✓	×	×
Increased activity	✓	×	✓	✓
Commercial fisheries				
Access to fishing grounds	✓	✓	✓	✓
Increased conflict over diminished grounds	×	×	×	×
Displacement of, or reduction in, fish and shellfish resource	✓	×	×	✓
Loss or damage to gear	✓	✓	×	×
Shipping & Navigation				
Increased journey	✓	✓	✓	✓
Collision between vessels	✓	×	✓	✓
Collision with array	×	✓	×	×
Disruption to search & rescue	✓	✓	✓	✓
Disruption to radar	×	×	×	×
Onshore traffic and Transport				
Disruption to local traffic and transport	×	×	×	×
Military Activity				
Temporary disruption to military activities	×	×	×	×
Disruption to military sonar	×	×	×	×
Archaeology and Cultural Heritage				
Damage to listed buildings or scheduled monuments	✓	✓	×	×
Noise				
Disturbance to surrounding community	✓	×	×	✓
Tourism & Recreation				
Disturbance to recreational activity	✓	✓	✓	✓
Possible tourist attraction	✓	✓	×	×
Airtraffic				
Collision with array	×	×	×	×
Interference with radar	×	×	×	×
Socio-economics				
Local employment	✓	×	✓	✓
Local spend	✓	×	✓	✓

7 FUTURE PROGRAMME / CONSULTATION

7.1 EIA process

As discussed in section 2.2, Policy and Legislation, an Environmental Impact Assessment will be required for the consenting process of the proposed tidal array at Kyle Rhea. The stages of the EIA process are outlined in table 7.1.

Table 7.1: Stages of the EIA process

Stage	Task	Aim/objective	Work/output (examples)	Public Participation and Consultation
Scoping	Scoping study	To identify the potentially significant direct and indirect impacts of the proposed development	Targets for specialist studies (e.g. hydrodynamic studies, sediment quality)	
EIA	Primary data collection	To characterise the existing environment	Background data including existing literature and specialist studies	Public participation is an important part of the planning process, in particular at the EIA and pre-application stages. Preliminary consultation with key consultees is considered important for setting the framework for consent. Consultation with statutory and non-statutory organisations and individuals with an interest in the area and the proposed development throughout the EIA process are likely to be regulated by the new consenting regime.
	Specialist studies	To further investigate those environmental parameters which may be subject to potentially significant effects	Specialist reports	
	Impact assessment	To evaluate the existing environment, in terms of sensitivity To evaluate and predict the impact (i.e. magnitude) on the existing environment To assess the significance of the predicted impacts	Series of significant adverse and beneficial impacts	
	Mitigation measures	To identify appropriate and practicable mitigation measures and enhancement measures	The provision of solutions to minimise adverse impacts as far as possible Feedback into the design process, as applicable	
	Environmental Statement	Production of the Environmental Statement in accordance with EIA guidance Including a Non Technical Summary (NTS).	Environmental Statement Four main volumes: • NTS • Written statement • Appendices • Figures	
	Pre-Application Consultation	Advertising of application for licensing must occur at least 12 weeks prior to submission of joint s36 Application	Joint s36/Licence Application (if applicable)	
	Post submission	Liaison and consultation to resolve matters or representations/objections	Addendum to ES	
EIA Consent Decision				

7.1.1 Environmental Statement

It is proposed at this stage that the Environmental Statement (ES) will comprise a single document combining text and graphics with a separate Non-Technical Summary of the information contained in the ES. Detailed specialist reports will be available as Technical Appendices where appropriate.

An additional Appropriate Assessment will be provided for reef features of the Lochs Duich, Long and Alsh SAC, as discussed in Section 4.1 (Designated Sites) of this scoping report. Appropriate Assessment may also be required for Otters as an annex II species present as a qualifying feature, but not a primary reason for site selection.

It is proposed the text of the Environmental Statement will be structured as follows.

Introductory Chapters

- **Overview of Renewable Energy**

An introduction to renewable energy development and in particular, tidal power will be outlined. It will give a short overview of the tidal resource in Scotland and Kyle Rhea, and will outline the potential benefits of the Tidal Site in terms of reduced emissions.

- **Overview of EIA methodology**

Will include an overview of the impact assessment methodology used for the EIA process including scoping and consultation and the identification of key environmental effects.

- **Site selection process**

A description of the site selection process for the tidal array will be outlined. It will describe the main alternatives studied and the main reasons for the choice of this site, taking into account the environmental effects. It will describe the way in which mitigation of environmental effects has been considered during site design, layout and the EIA process.

- **Project description**

Details of the site and a description of the proposed Tidal Site will be discussed. This will include details of the size, layout and design of the Tidal Site and associated onshore/offshore infrastructure. This chapter will also outline the construction, installation, operational, maintenance and decommissioning requirements of the project.

- **Policy and Legislation**

This section will present an overview of the relevant statutory planning guidance and Development Plan policies which apply to the Tidal Site on the proposed site.

EIA results

- **Physical Parameters**
  - Coastal Processes and Morphology
  - Water and Sediment Quality

- **Biological Parameters**
  - Ecology (Benthic, Terrestrial and Marine mammals);
  - Ornithology;
  - Fish and Shellfish;
  - Designated sites to be included in the relevant sections

- **Human Parameters**
  - Landscape and Seascape;
  - Commercial Fisheries;
  - Maritime Navigation;
  - Military Activity
  - Archaeology and Cultural Heritage; and
  - Socio-economics

Each chapter will begin with an introduction followed by a description of the method of assessment for the particular topic under discussion. This will include an outline of relevant consultations undertaken, documentation studied and the means of defining the Study Area for that topic. Should there be any difficulties (technical deficiencies or lack of knowhow) encountered in compiling the required information, this will be noted. The existing baseline conditions for the topic will then be described. An assessment will then be made of the nature, magnitude, duration and significance of the likely effects of the construction, installation, operation, maintenance, and decommissioning of the proposed Tidal Site on the topic.

Mitigation measures to avoid, minimise or remedy the predicted effects, where practical will be outlined. An assessment will be made of the significance of the likely residual effect, following mitigation.

Cumulative Effects

Cumulative impacts may arise from a combination of other projects. The proximity, nature and timing of work would need to be considered in the assessment of cumulative impacts. Other activities are likely to include existing marine activities (fishing and navigation) and extraction and disposal sites. The cumulative effects will be outlined within the ES.

Environmental Management Framework

Where elements of uncertainty remain regarding predicted effects (as part of the full EIA exercise) a monitoring programme and period of review maybe required. Any requirements for monitoring programmes will be discussed with the relevant regulatory authority and committed to as part of the EIA consultation process (see section 6.2. It would be expected that monitoring commitments would become subsequent consent conditions.

7.2 Consultation strategy

The need for effective public participation is identified throughout relevant legislation and planning guidance:

The **Public Participation Directive** (PPD) (Directive 2003/35/EC) was issued by the European Commission in order to provide members of the public with opportunities to participate on the consenting and ongoing regulation of certain categories of activities within Member States. Such opportunities are provided through access to information, justice, and through consultation on certain key documents.

The Directive makes specific changes to the way in which EIA is undertaken, and the EIA Directive[5] has been amended to incorporate these requirements. The PPD has also amended the Electricity Works (Environmental Impact Assessment) Regulations 2000 ("the Principal Regulations").

PAN81 was released by the Scottish Executive in 2007 to provide guidance to local authorities and developers when engaging communities through the planning process.

[5] Council Directive 85/337 on the effects of certain public and private projects on the environment as amended by 97/11/EC (and 2003/35/EC)

The **Planning Act (Scotland) 2006** outlines the need for public involvement and consultation in the planning system.

The Act requires applicants to undertake pre-consultation with local communities before submission of a planning application.

Whilst not yet applicable, the proposed Tidal Array will be developed in accordance with the new planning act in relation to community consultation and with due regard for PAN81: Community Engagement.

A Consultation Strategy would have a number or roles including:

- Informing all interested parties about the proposed project, its location, scale and extent and the work and studies that are being undertaken (where necessary methodologies for studies will have been discussed and agreed with statutory agencies);
- Identifying the need and benefits of the project and explaining the effects of different phases on particular groups;
- Providing clear opportunities for the public and other interests (e.g. fishermen, recreational sailors, local coastal residents) to ask questions and raise issues and concerns; and
- Ensuring continued communication throughout the process to both update the public on progress and, more importantly, endeavour to resolve concerns initially voiced.

7.2.1 List of Consultees

Table 7.2 identifies the authorities, groups and organisations that will be consulted as part of the EIA process. It is important to note that this list is not exhaustive and that it will develop as the EIA progresses. Those organisations highlighted in bold have been consulted during the initial pre-submission Scoping phase.

Consultee
Skye District Salmon Fisheries Board
BERR
CAA
Chamber of Shipping
Defence Estates
Sea Mammal Research Unit (SMRU)
Energy Consents Unit
Forestry Commission
Highland Council
Historic Scotland
JNCC
Glenelg to Kylerhea ferry (community owned)
Local Councilors
Marine and Coastguard Agency
Marine Conservation Society
Marine Scotland
NATS
Northern Lighthouse Board

Consultee
RNLI (Kyle of Lochalsh)
RSPB
Scottish Coastal Forum
Scottish Fisheries Protection Agency
Scottish Fishermen's Federation
Scottish Water
Scottish Wildlife Trust
Scotways
Sea Fish Industry Authority
SEPA
Scottish Natural Heritage
The Crown Estate
The Health and Safety Executive
The Royal Yachting Association
West Highland and Islands Sailing Club Association West Highland Anchorages and Moorings Association

7.2.2 Scoping Questions

The following questions highlight the main queries regarding this scoping study and when providing a Scoping Opinion it will be very helpful if these are considered:

- Have all regulatory requirements that the project should be taking into account been identified?
- Do the requirements outlined for assessment of effects look appropriate and complete?
- Are there any other key sources of environmental information that should be consulted?
- Have the most likely and significant effects been identified through this analysis? Are there any others that should be considered for inclusion in the full assessment process and if so why?
- Does the list of proposal consultees reflect the range of stakeholders that should be considered as consultees for this project?

8 REFERENCES

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C., & Buck, A.L., eds. 1997. Coasts and seas of the United Kingdom. Regions 15 & 16. North-west Scotland: the Western Isles and west Highland. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series.)

Christensen, T.K. & Hounisen, J.P. (2005) Investigations of migratory birds during operation of Horns Rev offshore wind farm. Annual status report 2004. Commissioned by Elsam Engineering A/S. National Environmental Research Institute. 35 pp.

Countryside Commission for Scotland (1978). Scotland's Scenic Heritage, Knoydart. Available at: http://gateway.snh.gov.uk/pls/portal/SNHTest_Site_Docs.Show_Site_Document?p_pa_code=9132&p_Doc_Type_ID=30

Connor David W., Allen James H., Golding Neil, Howell Kerry L., Lieberknecht Louise M., Northen Kate O. And Reker Johnny B. (2004) The Marine Habitat Classification for Britain and Ireland Version 04.05 *JNCC, Peterborough.*

Davies, J, Baxter, J, Bradley, M, Connor, D, Khan, J, Murray, E, Sanderson, W, Turnbull, C and Vincent, M (eds.). 2001. Marine monitoring handbook. Joint Nature Conservation Committee.

Davies, J.; Baxter, J. *et al.* (Ed.) (2001). Marine monitoring handbook. March 2001. Joint Nature Conservation Committee: UK. ISBN 1-86107-524-3. 405 pp

DECC, MCA, DfT, Defra, RYA, Crown Estate, BMAPA & Anatec (2009). Maritime Data. Available at: http://www.maritimedata.co.uk/default.aspx

Department for Communities and Local Governement (2006). Planning for the Protection of European Sites: Appropriate Assessment. Available at: http://www.communities.gov.uk/documents/planningandbuilding/pdf/160442.pdf

Department of Energy and Climate change (DECC). 2009. UK Offshore Energy Strategic Environmental Assessment: Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil & Gas and Gas Storage

Department of Trade and Industry (DTI), 2007. Fish & Fisheries in the SEA7 Area

DTI (undated). Guidance on the Assessment of the Impact of Offshore Wind Farms, Seascape and Visual Impact Report. Available at: http://www.berr.gov.uk/files/file22852.pdf

Emu Ltd. (2006). Site Condition Monitoring: Surveys of biogenic and rocky reefs in the Lochs Duich, Long and Alsh cSAC. Scottish Natural Heritage Commissioned Report No.240 (ROAME No. F02AC409).

Gardiner, R., & Egglishaw, H. 1986. Map of the distribution in Scottish rivers of the Atlantic salmon Salmo salar L. Edinburgh, Scottish Office Agriculture, Environment and Fisheries Department. (SOAEFD Publication A.)

Garrad Hassan (2001). Scotland's Renewable Resource. Available at: http://www.scotland.gov.uk/Resource/Doc/47176/0014633.pdf

Gill, A.B., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J. & Wearmouth, V. (2009). COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2: EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry. Commissioned by COWRIE Ltd (project reference COWRIE-EMF-1-06).

Hammond P.S., Northridge, S.P., Thompson, D., Gordon J.C.D., Hall, A.J., Duck, C.D., Aarts, G. Cunnhingham, L. Embling, C.B. and Matthiopoulos, J. (2006). Background information on marine mammals relevant to Strategic Environmental Assessment 7

Highland Council (1999). The Skye & Lochalsh Biodiversity Action Plan Available at: http://www.highlandbiodiversity.com/htm/counties/skye_lochalsh/skye_lochalsh.pdf

Highland Council (2008) West Highland and Islands Local Plan. Available at: http://www.highland.gov.uk/NR/rdonlyres/CD93A3E8-1E08-4764-A6A9-537277D481FA/0/WH_Written_Statement_December2008.pdf

http://www.forestry.gov.uk/forestry/Otter

http://www.forestry.gov.uk/website/wildwoods.nsf/LUWebDocsByKey/ScotlandHighlandNoForestKylerheaKylerheaOtterHavenCarpark

http://www.magic.gov.uk

http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp

Institute for Archaeologists (2008). Standard and Guidance for archaeological desk-based assessment. Available at: http://www.archaeologists.net/modules/icontent/inPages/docs/codes/dba2.pdf

JNCC (undated a). SAC selection, Lochs Duich, Long and Alsh Reefs. Available at: http://www.jncc.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0017077

JNCC (undated b) SAC selection, Ascrib, Isay and Dunvegan. Available at: http://www.jncc.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030230

JNCC 2004 Vertebrate species: mammals http://www.jncc.gov.uk/ProtectedSites/SACselection/species.asp?FeatureIntCode=S1355

JNCC undated: Standard Natura 2000 data form: Cullins SPA (UK9001781)
JNCC, (2007), Handbook for Phase 1 habitat survey - a technique for environmental audit, Revised reprint 2003, reprinted 2007

Kruuk, H., (1996). Wild Otters, Predation and Populations, Oxford University Press, Oxford, England.

Linley, E.A.S, Wilding, T.A, Black, K.D, Hawkings, A.J.S and Mangi, S. 2007. Review of the reef effects of offshore wind farm structures and their potential for enhancement and mitigation. Report from PLM Applications Ltd to the DTI.

Marico Marine (2007). The provision of additional studies in relation to the Scottish Executive Strategic Environmental Assessment for Marine Renewables, shipping and navigation. Available at: http://www.seaenergyscotland.net/SEA_Appendix_C15A.htm

MarLIN (undated). Sensitivity Assessment Rationale. Available at: http://www.marlin.ac.uk/sensitivityrationale.php

MFA (Marine and Fisheries Agency) 2010. The UK Fishing Vessel List for over 10m and under 10m vessels. Accessed at: http://www.mfa.gov.uk/statistics/vessellists.htm
MOD (undated). Low Flying Activity in My Area. Available at: http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/AirSafetyandAviation/LowFlying/LFAs/

National Biodiversity Network (2008). NBN Gateway. Available at: http://data.nbn.org.uk/interactive/map.jsp?srchSp=NBNSYS0000005135

Nedwell J R and Brooker A G (2008). Measurement and assessment of background underwater noise and its comparison with noise from pin pile drilling operations during installation of the SeaGen tidal turbine device, Strangford Lough. Subacoustech Report No. 724R0120 to COWRIE Ltd. ISBN: 978-0-9557501-9-9. Available at: http://www.offshorewindfarms.co.uk/Assets/Final%20report_26%2001%2009.pdf

Nedwell, J., Langworthy, J., and Howell, D., (2003) Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore wind farms, and comparison with background noise. Subacoustec report to COWRIE, reference 544R0424. May 2003. Subacoustech Ltd, Chase Mill, Winchester Road, Bishop's Waltham, Hampshire S032 1AH, UK. 55pp.

Nolet , B.A., Wansink, D.E.H., and Kruuk, H. (1993)Diving of otters (Lutra lutra) in a marine habitat: use of depths by a single prey loader. Journal of Animal Ecology.62. 22-32

Parvin, S.J, Nedwell, J.R., and Workman, R. (2006) Underwater noise impact modelling in support of the London Array, Greater Gabbard and Thanet Offshore Wind Farms. Subacoustech report No. 710R0517

Penrose R.S. (2005). UK & Eire Marine Turtle Strandings and Sightings Annual Report 2004. Available at: http://www.strandings.com/Graphics%20active/2004%20Turtle%20Stranding.pdf

Penrose R.S. (2007). UK & Eire Marine Turtle Strandings and Sightings Annual Report 2006. Available at: http://www.strandings.com/Graphics%20active/2006%20Turtle%20Strandings%20Report.pdf

Ramsay, D.L. and Brampton, A.H. 2000. Coastal Cells in Scotland: Cell 5 – Cape Wrath to the Mull of Kintyre. Scottish Natural Heritage RSM Report No. 147.

RCAHMS (2008). Pastmap. Available at: http://jura.rcahms.gov.uk/PASTMAP/Map

Reid J.B., Evans, P.G.H. and Northridge, S.P. (2003). Atlas of Cetacean distribution in north west European water. Joint Nature Conservation Committee.

Royal Haskoning (2009). Seagen Project. SNH Sharing Good Practice Conference 2009. Available at: http://www.snh.org.uk/pdfs/sgp/A303239.pdf

Royal Haskoning (in press). SeaGen turbine, Strangford Lough April 2010 Biannual Report

RWE Group (2005) Ornithology. In: Annual FEPA Monitoring Report 2005. North Hoyle Offshore Wind Farm. Report to npower renewables.

Scottish Executive. Marine Renewables SEA.

Scottish Government (2000). Guidance on The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000. Available at: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/ElectricityWorksEIARegs

Scottish Government (2008). Sustainable Seas for all, a consultation on Scotland's first marine bill. Available at: http://www.scotland.gov.uk/Resource/Doc/231463/0063135.pdf
Scottish Government (2009). Energy – Taking forward our national conversation. Available at: http://www.scotland.gov.uk/Publications/2009/11/25093815/4

Scottish Government. 2008. Scottish Sea Fisheries Statistics.

Scottish Natural Heritage (SNH): SiteLink: Accessed at: http://gateway.snh.gov.uk

Scottish Natural Heritage 2009 Citation for Rum Scottish Protection Area (UK9001341) including marine extension

Sea fisheries division of Marine Scotland: Accessed at: http://www.scotland.gov.uk/Publications/2009/09/11100225/0

SEPA, 2009. Shellfish growing waters and SEPA monitoring sites. Kyle Rhea. Report reference number 57.

SEPA. 2006. Scotland's Water Environment Review - Coastal water quality 2000-2006

SNH (2006). Lochs Duich, Long and Alsh Reefs Special Area of Conservation. Advice under Regulation 33(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Available at: http://www.ukmpas.org/pdf/Sitebasedreports/Lochs_Duich_Long_and_Alsh_Reefs.pdf

SNH (2008). Guidance on Landscape/ Seascape Capacity for Aquaculture. Available at: http://www.sarf.org.uk/News_PDF/SNHGuidance%20on%20LandscapeSeasacpeAquaculture.pdf

SNH (2010). Interactive Map. Available at: http://www.snh.org.uk/snhi/map.asp

SNH 2002: Kinloch and Kyleakin Hills SSSI Statement of Importance

Stanton, C. (1996). Skye and Lochalsh landscape assessment. Scottish Natural Heritage Review. No 71. Available at: http://www.snh.org.uk/publications/on-line/LCA/skyelochalsh.pdf

The Highland Local Biodiversity Action Plan: http://www.highlandbiodiversity.com/htm/counties/skye_lochalsh/skye_lochalsh.pdf

Turner, H. (2010). Pers comm

Visit Scotland (undated). The Best Sea Kayaking in Europe. Available at: http://adventure.visitscotland.com/content/pdf/sea-kayaking-factsheet

Wilding, T. A., Hughes, D. J. and Black, K. D. (2005) The benthic environment of the North and West of Scotland and the Northern and Western Isles: sources of information and overview. Report 1 to METOC. Scottish Association for Marine Science, Oban, Scotland, PA37 1QA.

APPENDIX 1 – ECOLOGICAL MONITORING PLAN

A1.1 Monitoring required

Baseline data collection will be required to determine the benthic species and habitats present at the site, as well as and the use of the site for by birds, marine mammals and basking sharks.

The benthic ecology as well as the activity of birds, marine mammals and basking sharks will vary seasonally, and baseline data will be collected over a full year to account for this.

It may be possible to 'deploy and monitor' after one year of baseline data collection. This approach would be in keeping with the 'deploy and monitor' approach recently proposed by Marine Scotland for wave and tidal devices.

A second year of baseline data may be required prior to installation for some receptors, although this is not currently anticipated. A decision on requirements for further baseline data collection, or the form a 'deploy and monitor' strategy would take, will be made after consideration of the first year of data. All monitoring decisions will be taken in consultation with Scottish Natural Heritage (SNH) and Marine Scotland (MS).

It is anticipated that if post installation monitoring is undertaken then it would be likely to support the assessment of potential impacts of the devices on benthic ecology, ornithology, marine mammal and / or basking sharks.

A1.2 Key Drivers

The monitoring programme will be designed to robustly and adequately inform:

- The Environmental Impact Assessment (EIA) process (Scottish Planning Series Planning Circular 8-2007: The Environmental Impact Assessment (Scotland) Regulations 1999);
- An Appropriate Assessment (AA) as required under the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (seals, marine birds and benthic habitats only); and
- That, for cetaceans and basking sharks, no species is disturbed, killed or injured by the development without licence under the Conservation (Natural Habitats, &c.) Regulations 1994 or the Wildlife and Countryside Act 1981 as amended by the Nature Conservation (Scotland) Act 2004.

There is a requirement to prove that there will be no significant impact caused by installation or operation of the devices, beyond reasonable scientific doubt. Evidence to date from the installation of the single SeaGen device in Strangford Lough in Northern Ireland has reported:

- No impacts on existing benthic habitats;
- No apparent barrier effect on harbour porpoise, common or grey seals; and
- Seals are most active at the SeaGen site at either side of slack water in the tidal cycle.

The monitoring of seals and birds is ongoing and findings are yet to be confirmed.

Monitoring Guidance

SNH recently contracted Royal Haskoning to prepare monitoring guidance for the deployment of wet renewables devices in Scotland. Royal Haskoning is working with experts in benthic, bird and marine mammal ecology to prepare this guidance and the contract is due to be completed in summer 2010. The monitoring programme for the deployment of SeaGen turbines at Kyle Rhea will be informed by the monitoring guidance under preparation as well by experience and lessons learned from the ongoing monitoring programme conducted for SeaGen, Strangford Lough.

A1.3 Birds

Baseline and monitoring questions:

- Is the proposed array site used by species whose ecology makes them potentially vulnerable to installation or operation?
- Are there species present in adjacent terrestrial areas which could be impacted by the site and associated activities?
- If baseline surveys show important or vulnerable bird species use the array site, does the pattern of use change after installation?

Initial investigations during scoping have not identified data that suggest the array site is an important location for birds. However, a number of species with potential to interact with SeaGen devices may use the site and baseline monitoring may be required. This will be confirmed in responses to scoping. In anticipation, and based upon experience, the following outline approach to monitoring is proposed:

Baseline development

- Vantage Point (VP) surveys from two locations would aim to complete 12 hours of observation each month, split over approximately 16 monitoring sessions throughout the year. This will aim to precisely record the position of each bird (from a compass bearing and angle of declination) using specialist equipment; and
- Coastal walkover surveys will be completed to assess numbers and distribution of breeding seabirds and any cliff-nesting raptors in the area.

The baseline data collection will begin in April 2010, in advance of any scoping response, to allow the data collected to encompass the entire breeding bird season. It is anticipated that surveys would continue until April 2011 initially, however, there will be ongoing evaluation of the baseline data and if results indicate that potential for impacts is limited then the strategy for data collection could be revised.

Monitoring

If indicated as appropriate by baseline data, post installation, VP surveys could be undertaken using the same methodology.

A1.4 Marine Mammals

Baseline and monitoring questions:
- Is the proposed array site used by marine mammals?
- What is the temporal (season, tidal state etc.) and spatial distribution and abundance of marine mammals in the area?
  - If baseline surveys show marine mammal use the site, does installation and operation change the pattern of use?

Marine mammal activity (both cetacean and pinniped) has been identified within Kyle Rhea during scoping. In addition, otter is also present, and are understood to cross the kyle. The collection of data will be designed to establish a baseline of marine mammal activity in the kyle, identifying areas used by animals and the intensity of use. Against this baseline, changes to the degree and pattern of use post installation could be identified and assessed.

Baseline development

Baseline observations will be conducted for a minimum of 12 months, in parallel with data collection for ornithology.

The following methodology will be incorporated into the monitoring programme:

- Vantage Point observations will be undertaken concurrently with ornithological VP surveys, using the same methodology. Observations of otters, turtles and basking sharks will also be recorded.

Monitoring

Post installation, VP surveys can be undertaken using the same methodology if such an approach is indicated by assessment of baseline data.

It is considered highly unlikely that there will be any interaction between SeaGen rotors and marine mammals, however, MCT has developed a method for detection of impacts upon the rotors of SeaGen devices by objects of 50kg or larger (sufficiently sensitive to detect impact by adult seals). It is proposed that post installation this system is used on the devices deployed. Marine Scotland is in the process of instigating an enhanced marine mammal carcass reporting and autopsy programme in Scotland. It is suggested that this programme should include all locations where wet renewable devices are deployed, including the area of the proposed array.

A1.5 Benthic Habitats and Species

The site is designated a Special Area of Conservation, encompassing the Annex I feature of reef habitat. The baseline data collection for this feature should provide sufficient information to inform an Appropriate Assessment.

Baseline and monitoring questions:
- What is the extent and distribution of reef biotopes in the Kyle Rhea study area?
- What is the species composition of the reef biotopes which could this potentially be influenced by the array?
- Post installation; are there any changes to reef biotopes attributable to influence of the array?

Baseline development

Baseline data collection methods for benthic habitats and species are likely to encompass the following:

- Acoustic seabed mapping using multibeam swath bathymetry and other systems if appropriate. In order to develop seabed mapping data into indicative biotope distribution maps acoustic mapping will be ground truthed using physical and visual sampling methods (see below);
- Visual survey data will be collected at a number of locations using drop video and diver survey methods. Visual survey will largely follow a randomised sampling regime, with a smaller number of 'reserved' samples which will be directed; and
- Where sediment is indicated by acoustic mapping, physical sampling may be undertaken using grabs.

Diver sampling provides an opportunity to collect detailed biological data. It is anticipated that this would focus on proposed installation locations for SeaGen devices. Diver survey methods will be agreed with Marine Scotland and SNH; however, they may include all or some of the following:

- Transect surveys, with quadrat sampling using semi quantitative of percentage cover methods of estimating abundance. It is anticipated that this method would be used pre installation and would focus on potential locations for installation of SeaGen devices; and / or
- Point surveys with Phase 2 MNCR methods, with SMB tracking of diver teams.

Monitoring

After SeaGen device locations have been determined, both pre and post installation survey could include a selection of the following methods:

- Fixed quadrats / quadrats at repeatable locations, using percentage cover or counts. Divers will undertake the surveys at a number of fixed monitoring stations in an agreed downstream axis from the array – as well as control / reference location(s) with similar ecology. The locations of the monitoring stations will be at agreed distances from the array in the agreed 'downstream' direction; and / or
- Randomised visual seabed survey using drop video or divers.

It is proposed that seabed monitoring is undertaken over a 1 year period to enable consideration of seasonal changes in ecology to be made.